Modelling fruit and vegetable consumption : a comparative study of two cities with high and low consumption

Thesis

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MODELLING FRUIT AND VEGETABLE CONSUMPTION: A COMPARATIVE STUDY OF TWO CITIES WITH HIGH AND LOW CONSUMPTION

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Abstract

The importance of the consumption of a diet rich in fruit and vegetables, for overall health, has been highlighted by the UK government in recent years. Consumption of fruit and vegetables is considerably lower in Scotland than in other parts of the UK. Behavioural change is most likely to come about through a comprehensive understanding of the range of factors influencing fruit and vegetable consumption, and the nature of the interaction of these factors.

With variations in fruit and vegetable consumption by place and social class, this study focused on an area of low fruit and vegetable consumption in Scotland, and compared this to an area of high fruit and vegetable consumption in England, with socio-economic profile matched. The determinants of consumption, and their interrelationship, were investigated using qualitative information from focus group discussions, and quantitative data from a structured questionnaire. Multivariate models of fruit and vegetables consumption were developed, using log linear analysis, logistic regression and discriminant analysis.

The models developed identified significant differences between fruit and vegetable consumption behaviour. Fruit consumption was mainly influenced by socio-demographic variables, in particular smoker status. The impact of place and social class was substantial, when these variables were considered in interaction with the other socio-demographic variables. In contrast, vegetable consumption was influenced by motivational and attitudinal factors. Of these, the extent to which vegetables satisfied 'convenience' expectations, and 'hedonic motivations' were the most important influences, critical to vegetable consumption. The findings also suggest that the development of a generic model of food choice may not be an achievable goal, since the

models of these two (similar) foodstuffs are so different. Strategies to promote fruit and vegetable consumption, must address the different characteristics, and priorities, of low fruit and vegetable consumers.

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GLOSSARY OF TERMS AND ABBREVIATIONS

MAFF	Ministry of Agriculture, Fisheries and Food
SOHHD	Scottish Office Home and Health Department
DEPCAT	Deprivation category
F&V	Fruit and vegetables
WHO	World Health Organisation
COMA	Committee on Medical Aspects of Food
OPCS	Office of Population and Census Surveys
CHD	Coronary Heart Disease
FFQ	Food frequency questionnaire
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action

Chapter 1 Introduction

1.1 Research context and objectives

The role of diet in protecting against ill health has been the focus of a great deal of attention over the last decade. In particular, attention has centred on fruit and vegetables, and the benefits from increased consumption of these foodstuffs. High consumption of fruit and vegetables is believed to afford protection against a range of degenerative diseases associated with contemporary Western lifestyles (Block, 1991; Gey, 1986), and is often offered as an explanation as to why countries in southern Europe experience lower incidences of coronary heart disease and various cancers (James et al, 1989). The level of consumption of fruit and vegetables is believed to be a very good indicator of the overall health of a country (Leather, 1995).

In the UK levels of fruit and vegetable consumption are well below the 400g per day (5 portions) recommended by the World Health Organisation (1990), which is also the health target set by the UK Government in 1992. Specifically, within Scotland, consumption levels are very low and were reported as only 181g/day in 1993 by the Scottish Diet report (SOHHD, 1993). This is particularly disturbing given Scotland's unenviable position of displaying the highest levels of coronary heart disease and cancer in the world (WHO, 1990).

It is therefore considered that Scotland's health could be greatly improved through these dietary changes which would incorporate greater proportions of fruit and vegetables. As increasing fruit and vegetable consumption is a positive behavioural change, it is considered more desirable and easier to promote than dietary recommendations which require reducing intake of specific more harmful foods. However, despite a range of initiatives aimed at encouraging increased consumption of fruit and vegetables (both by health authorities, such as the Health Education Board for Scotland, and by retailers such as Iceland (Baxter and Schroder, 1997)), consumption levels have not increased in recent years (MAFF, 1996). Why fruit and vegetable consumption has not increased is unclear, but it is becoming increasingly apparent that fruit and vegetable consumption is a complex behaviour, influenced by a range of factors. The quality of fruit and vegetables available is known to be important to food choice (Foster and Macrae, 1992). This is closely linked to issues such as access or distribution, where people live, and socio-economic status (Forsyth et al, 1994; Mooney, 1990). However, as with consumption of any product, there are also powerful motivational and attitudinal issues surrounding fruit and vegetable consumption. Anderson et al (1994b) found many people had positive beliefs and opinions about fruit and vegetable consumption, yet still had low consumption. The main suggestion from this work was that more research was required considering 'attitudinal and motivational' factors. It is clear that there are important psychological, economic and demographic factors influencing fruit and vegetable consumption, but that our understanding of these factors and their interrelationship is still in its infancy.

The principal objective of the present research, therefore, was to improve understanding of fruit and vegetable consumption behaviour, which would assist in instigating dietary change *via* better informed strategies aimed at increasing consumption.

1.1.1 Disciplinary issues

A number of disciplines are relevant to this subject. The health issues surrounding increased fruit and vegetable consumption make it an interesting topic of study to those involved in health education and promotion. As fruit and vegetables are a commercially available product, increasing fruit and vegetable consumption is also of interest to marketing. Studies addressing some of the issues associated with fruit and vegetable consumption have already emerged from disciplines such as nutritional science, food science and social psychology (Cox et al, 1997; Laforge et al, 1994; Anderson et al, 1994b). All have a focus on consumption (although the contexts of study may vary), and it seems appropriate to this author that the study of fruit and vegetable consumption should be placed loosely within the field of Consumer Behaviour, which, in itself, can be characterised as a discipline of the Social Sciences.

1.2 Original contribution

This research examines a relatively under investigated area and in the process makes several contributions to knowledge. The main contribution lies with the construction of a model of fruit and vegetable consumption, which has clear implications for health promoters and marketers. This research also makes a contribution in the area of food choice modelling and food choice theory, by suggesting that a generic model of food choice may be an unattainable goal.

1.3 Methodological approach

1.3.1 Methodological context

This study is essentially problem driven and inductive, and as such does not engage in theory testing. However, it is concerned with modelling fruit and vegetable consumption behaviour, and thus draws on theoretical frameworks from consumer behaviour.

Human behaviour generally arises out of an interaction between the individual and his or her physical and social environment (Ogilvy, 1987). For fruit and vegetable consumption this could be extended to the relationship between the individual, the food and the context (physical, social and economic) in which consumption occurs (Shepherd, 1989). Social and physical influences are recognised as important, perhaps not influencing consumption *per se*, but influencing the processes that lead up to consumption.

Fruit and vegetable consumption is, therefore, influenced by a wide range of factors, and a methodological approach that recognises and addresses this is required. While there are theories from social psychology and consumer behaviour which attempt to introduce a social dimension (e.g. Ajzen's Theory of Planned Behaviour, 1988), from psychology which focus on the individual (e.g. Jacoby, 1977) and some with a focus on the consumer responding to situational influences (e.g. Foxall, 1993), these have limited explanatory powers, suitable only in narrow domains. It was felt by this author that there was no one theoretical perspective which presented a methodology suitable for studying this behaviour.

The main concern of this study was, therefore, the development of a model representing fruit and vegetable consumption, which encompassed the individual in his or her social and physical context. As such, this study takes its methodological perspective from work in the fields of marketing, consumer behaviour, social psychology, food science, nutritional science and health promotion, and is interdisciplinary.

1.3.2 The methods chosen

This research takes an inductive approach initially, to explore fruit and vegetable consumption behaviour and the main factors influencing this behaviour. The rationale was to first use focus groups to develop a range of factors, which would provide the basis for a survey providing quantitative data. This would, in turn, be used to further explore the relationships between important factors influencing fruit and vegetable consumption, and lead to the development of models of fruit and vegetable consumption.

Focus groups were conducted in areas of high and low fruit and vegetable consumption, and in areas of high and low socio-economic status. This first stage set out to establish the range of factors influencing fruit and vegetable consumption, including attitudes and motivations to consume fruit and vegetables. Analysis of the focus group transcripts led to the development of a conceptualisation of the full range of influences on fruit and vegetable consumption.

It was clear from the focus groups that there were different reasons for consuming (or not) fruit and vegetables, reflecting the different goal structures of participants in the study. High level goals, such as healthiness and self-esteem, were strong influences for those who consumed, while lower level goals (such as problems associated with perceived convenience of fruit or vegetables) played an important role in constraining consumption. Since these lower level goals appeared to be a major issue for non or low consumers of fruit and vegetables, a quantitative survey was conducted to explore further the nature of the factors influencing consumption. The quantitative stage was based on the conceptualisation emerging from the focus groups, and was essentially inductive, in that the aim was to quantify descriptions of the relationships. Multivariate analysis was applied to the data, leading to the development of a model of fruit and vegetable consumption. The modelling approach used both non-parametric and parametric multivariate statistics to model the most salient factors (both psychological and socio-demographic variables) influencing fruit and vegetable consumption.

1.4 Structure of the thesis

This thesis continues with a literature review (Chapter 2), where the significance of research into fruit and vegetable consumption, and the various theoretical approaches that might be taken to research this consumption behaviour, are examined. Chapter 2 places the discussion of fruit and vegetable consumption within the context of goal-directed behaviour, concluding with a discussion of the impediments and facilitators to fruit and vegetable consumption behaviour.

The aims of the research are presented in Chapter 3, which discusses the implications of the literature review and the utility of this research. An overview of the methodological approach is also given, followed by a description of the methodologies used, and modelling approach taken. Chapter 4 develops the discussion on qualitative research in general, and presents findings from the focus group discussions into fruit and vegetable consumption. Results from the quantitative stage of the thesis are presented in analysis Chapters 5, 6 and 7. Chapter 5 presents the exploratory analysis of the data while Chapters 6 and 7 present models of fruit and vegetable consumption respectively. These results are discussed as they are provided. Finally, in Chapter 8, the success or otherwise of the research is evaluated and suggestions made for future work in this area.

Chapter 2 Literature review

2.1 Introduction

The relationship between diet and health is well established, and there has been a clear focus of UK health policy in recent years to effect improvements in the health of the population through encouraging uptake of a healthier diet (e.g. SOHHD, 1996; SOHHD, 1993; COMA, 1994). While the diet of the UK is notably poorer than other countries in Europe, particular concern has focused on Scotland, because of its poor diet combined with a poor health record (SOHHD, 1993). Increasing fruit and vegetable consumption has been the focus of many initiatives, since consumption of fruit and vegetables has been implicated in offering protection against diseases, such as cancer and coronary heart disease. Effecting this change in fruit and vegetable consumption would be facilitated by an increased understanding of fruit and vegetable consumption behaviour (Lefebvre, 1993).

This chapter has three main sections. The first section considers the role of diet (and fruit and vegetables) in disease prevention, while the second part discusses the various theoretical approaches that might be taken to research this consumption behaviour. Arguing a goal-directed approach is appropriate, the chapter then goes on to discuss the impediments and facilitators to fruit and vegetable consumption behaviour. Research questions are proposed in the third and final section of this chapter.

2.2 The role of diet in general health

This section begins by considering the incidence of coronary heart disease and cancers in the UK, and evaluating these figures within the global context. The protective mechanisms of diet, especially fruit and vegetables, against such disease is then outlined. Finally, variations in levels of fruit and vegetable consumption are discussed.

2.2.1 Incidence of degenerative diseases

Mortality rates from coronary heart disease for both men and women in Scotland are among the highest in the world (WHO, 1990; Tunstall-Pedoe et al, 1986), while the position for the rest of the UK is only slightly better. Scottish men and women have the highest premature mortality rates from coronary artery disease in the world, closely followed by the Eastern European countries, while the Mediterranean countries have the lowest recorded levels of coronary heart disease (SOHHD, 1993).

The geographical pattern of coronary heart disease in Scotland shows considerable variation (higher in the west than in the east) and complexity (Crombie et al, 1986), and poses the question of what underlying factors are responsible for this distribution. Stomach cancer rates are also high in Scotland compared with other European countries, and much higher than the USA, while levels of large bowel cancer are also high (SOHHD, 1993). Scotland has a worse record than any other country for lung cancer, and the incidence of breast cancer is one of the world's highest, with cancer of the prostate also very common (WHO, 1990).

2.2.2 Diet and disease

Major recognised risk factors of CHD (smoking, raised serum cholesterol and hypertension) account for only 50-60% of the variance in its occurrence (Gey, 1986). Other factors are known to play a role, such as lack of physical exercise, but diet in particular is an important influence. Composition of diet is associated with a variety of illnesses, for instance excessive fat intake has been implicated in coronary heart disease and cancer (Curry et al, 1992), as well as contributing to weight gain, while high salt intake leads to increased blood pressure. High sugar intake may lead to dental caries, and high dietary fibre intake is emerging as protective against bowel cancer. Fruit and vegetables are also important in protecting against heart disease and cancer (Block, 1991; Gey, 1986).

2.2.3 Fruit and vegetables and disease

Recently emerging understanding of the mechanisms of protection afforded by fruit and vegetables suggests they have a role in protecting against many degenerative diseases, such as coronary heart disease and cancers, by virtue of an array of important vitamins and other bioactive molecules (Block, 1991). A diet abundant in the antioxidant vitamins C, E and beta-carotene (e.g. the 'Mediterranean' diet) is likely to be protective against CHD and cancer (Ziegler, 1991). Pursuit of this hypothesis suggests that the populations of Mediterranean countries are protected by virtue of their plentiful intake of fruit and vegetables (James et al, 1989), as evidenced in their levels of CHD being considerably lower than in Scotland (WHO, 1990).

Cancer protective factors are also thought to be present in fruit and vegetables (Block, 1991) although the precise mechanisms are not clearly understood. Diets rich in fruits and vegetables appear to protect against cancers such as that of the lung, large bowel, oesophagus, and stomach (Ziegler et al, 1992). This protective effect may be due to the antioxidant vitamins which the diet contains, but may also be due in part to the possible protective effects of non-starch polysaccharides. In addition to vitamins C and E, beta-carotene and fibre, vegetables contain numerous colouring and flavouring substances including flavonoids, tannins, iosthiocyanates, indoles and phenols (Bingham, 1990). The many different mechanisms of action of the naturally occurring anticarcinogens may cause synergisms that further increase the importance of even small amounts of non-nutritive plant constituents (Dragsted et al, 1993). The benefits, or otherwise, of these substances in human cancer is therefore uncertain; however, a clear picture is emerging from case-control studies showing a protective effect for fruit and vegetables, particularly in stomach and large bowel cancer (Bingham, 1990). Because of the uncertainty surrounding the precise mechanism of protection afforded by fruit and vegetables, vitamin supplements as a substitute for fruit and vegetables may not exert the same protective properties. For this reason emphasis has been on the increased consumption of fruit and vegetables (Dragsted et al, 1993), as opposed to consumption of dietary supplements to increase levels of the important antioxidants.

Apart from providing antioxidant vitamins and minerals, diets high in fruit and vegetables may contribute to modulation of blood lipoproteins and may inhibit hypertension (Singh et al, 1992), thus contributing to the abating of two of the major risk factors associated with CHD (hypertension and raised serum cholesterol). Increased fruit and vegetable consumption will compensate for decreases in fat intake (Singh et al, 1992), provide a means of reducing sucrose intake (as a substitute for cakes, sweets, etc. as snacks and puddings), whilst increasing intakes of non-starch polysaccharides (dietary fibre).

2.2.4 Focus of health policy on fruit and vegetables

Clearly concerned about the state of the nation's health, the Chief Medical Officer established a Working Party in 1992/3 to "survey the current diet of the Scottish people;... assess the relevance of diet to health; ....make proposals, if appropriate, for improvements in the Scottish diet; and ... assess their likely impact" (SOHHD, 1993: 1). The Scots diet emerged as excessively high in fat, refined sugars and salt, while low in consumption of fruit, vegetables (and hence the antioxidant vitamins present in fruit and vegetables: C, E and beta-carotene) and fibre (non-starch polysaccharides). This diet is one which could exacerbate disease within the Scottish population.

Thus, an increase in fruit and vegetable consumption may contribute to the achievement of some of the other dietary targets made in the Scottish Diet report (SOHHD, 1993), such as reducing obesity, thus promoting better <u>overall</u> health.

2.2.5 Current levels of consumption of fruit and vegetables

2.2.5.1 UK variations

Consumption of fruit and vegetables varies considerably throughout the UK (MAFF, 1996). However, it is considerably lower in Scotland than in the rest of the UK (Gregory et al, 1990) and there can also be seen a greater number of Scottish non-consumers in every variety of fruit and vegetable except oranges and other citrus fruits (Gregory et al, 1990). In 1996, the National Food Survey (MAFF, 1996) conducted a special analysis of fruit and vegetable consumption in the UK, based on 1995 levels of consumption. This National Food Survey data (MAFF, 1996), highlights the still poor fruit and vegetable consumption in Scotland; levels are considerably lower in Scotland than in all other regions of the UK. Fruit and vegetable consumption levels are reported in Table 2.1. Potatoes are omitted from the analysis, since the WHO (1990) recommendation of consumption of 400g of fruit and vegetables per day excludes potatoes (which have a separate dietary target).

Table 2.1 ***Consumption of fruit and vegetables by region, 1995***

	Fresh green veg (g/p/wk)	*Other fresh veg (g/p/wk)*	*Other veg[1] (g/p/wk)*	*Fresh fruit (g/p/wk)*	*Fruit products[2] (g/p/wk)*	*Daily intake of fruit and vegetables (g/p/day)*
Northern	180	430	436	538	235	260
Yorkshire and Humberside	228	470	413	663	337	302
N.West	183	424	384	598	285	268
E. Midlands	276	503	415	698	356	321
W. Midlands	246	471	383	656	312	295
S. West	244	507	342	733	399	318
S. East/E. Anglia	247	510	365	747	346	316
England	234	482	382	685	331	302
Scotland	**136**	**359**	**299**	**558**	**264**	**231**
Wales	228	460	402	647	321	294

Source: National Food Survey, 1995 (MAFF, 1996)
Key: g/p/wk = grams per person per week

[1] Canned, bottled, frozen and other vegetable products, excluding potato based produce.
[2] Fruit juices and other fruit products

Table 2.1 presents a worrying picture of consumption of fruit and vegetables in the UK, but especially so for Scotland. Daily intake of fruit and vegetables, while higher than that put forward in 1993 as typical of daily fruit and vegetable consumption in Scotland[3], is still below the WHO recommendations. High fruit and vegetable consumption was characteristic of the southern areas of the UK. East Midlands had highest daily consumption of fruit and vegetables, closely followed by the South West and South East.

While the National Food Survey data on fruit and vegetable consumption has not been produced to this level of detail in previous years (potatoes are normally included under vegetables), fruit and vegetable consumption has consistently been lower in Scotland than the rest of the UK, and the highest levels of consumption have been in the South (MAFF, 1993; MAFF, 1994; MAFF, 1995).

2.2.5.2 Variations by selected demographics

The National Food Survey data, also shows variations in fruit and vegetable consumption by social class, household composition and age.

Taking income of head of household as a proxy indicator of social class, Table 2.2. shows variations in fruit and vegetable consumption by income of head of household.

[3] 181g per day was the value found in Gregory et al 1990. Although different sources are used for these values (hence not directly comparable), consistently consumption levels have been far lower in Scotland than in the rest of the UK.

Table 2.2 Consumption of fruit and vegetables by income of head of household, 1995

	Fresh green veg (g/p/week)	*Other fresh veg (g/p/week)*	*Other veg[4] (g/p/week)*	*Fresh fruit (g/p/week)*	*Fruit products[5] (g/p/week)*	*Daily intake of fruit and vegetables (g/p/day)*
Household with one or more earners						
£570 and over	224	556	314	847	435	339
£300-570	204	485	357	695	378	303
£140-300	198	421	405	567	279	267
Under £140	210	398	423	496	227	251
Household without an earner						
£140 or over	364	705	377	1105	428	426
Under £140	217	410	383	571	258	263

Source: National Food Survey, 1995 (MAFF, 1996)
Key: g/p/wk = grams per person per week

On a daily basis, overall fruit and vegetable consumption is highest amongst those on higher incomes. Interestingly, the greatest differences between income groups are seen for fruit consumption, suggesting it is more closely related to money available within the household. The difference between those with an income and those without, may be explained by the fact that included in the category 'household without an earner – over £140' are those who are retired, but receiving a good pension. This suggests there may be a relationship between age and intake, with those who are older consuming more. This is supported by evidence from the Scottish Health Survey (1995) which shows a greater percentage of those in the older age groups (above 55) eating fruit, cooked vegetables and root vegetables on a frequent basis.

[4] Canned, bottled, frozen and other vegetable products
[5] Fruit juices and other fruit products

Table 2.3 shows variations in fruit and vegetable consumption by household composition.

Table 2.3 Consumption of fruit and vegetables by household composition, 1995

No. of adults	No. of children	*Fresh green veg (g/p/week)*	*Other fresh veg (g/p/week)*	*Other veg[6] (g/p/week)*	*Fresh fruit (g/p/week)*	*Fruit products[7] (g/p/week)*	*Daily intake of fruit and vegetables (g/p/day)*
1	0	297	541	388	911	364	357
1	1 or more	133	299	416	421	306	225
2	0	319	623	414	894	383	376
2	1	188	424	386	517	323	263
2	2	155	363	395	535	304	250
2	3	114	282	316	453	239	200
2	4 or more	106	300	348	424	229	201
3	0	278	518	401	712	298	315
3	1-2	169	412	349	540	308	254
3	3 or more	139	389	273	492	140	205
4	0	235	552	395	726	317	318

Source: National Food Survey, 1995 (MAFF, 1996)
Key: g/p/wk = grams per person per week

This table shows the relationship between household composition and fruit and vegetable consumption. These values represent per capita consumption, and reflect, to a certain extent, the lower nutritional requirements and appetites of children in comparison to adults. Nonetheless, it appears that the presence of children in a household conspires against consumption of fruit and vegetables; the greater the number of children the lower the consumption of fruit and vegetables. Consumption of both fruit and vegetables was markedly higher in household with no children.

The variations in fruit and vegetable consumption by age are shown in Table 2.4.

[6] Canned, bottled, frozen and other vegetable products
[7] Fruit juices and other fruit products

Table 2.4 ***Consumption of fruit and vegetables by age, 1995***

Age of main diary keeper	*Fresh green veg (g/p/week)*	*Other fresh veg (g/p/week)*	*Other veg[8] (g/p/week)*	*Fresh fruit (g/p/week)*	*Fruit products[9] (g/p/week)*	*Daily intake of fruit and vegetables (g/p/day)*
Under 25	118	297	328	372	254	196
25-34	134	351	368	463	268	226
35-44	178	421	377	573	323	267
45-54	274	591	408	799	388	351
55-64	341	630	391	948	348	378
65-74	367	571	380	958	367	377
75 and over	294	452	278	847	286	308

Source: National Food Survey, 1995 (MAFF, 1996)
Key: g/p/wk = grams per person per week

As suggested by Table 2.4, and the Scottish Health Survey (1995), consumption of fruit and vegetable is lowest amongst the under 25s, increasing with age. Highest fresh fruit and vegetable consumption was among the 65-74 age group, explained by this group's higher consumption of more traditional varieties of vegetables and fruit (MAFF, 1996).

There are clearly great variations in fruit and vegetable consumption by socio-demographic variables, suggesting these factors are major influences on level of consumption. However, whilst it is possible to speculate as to why fruit and vegetable consumption varied by these factors, there appears to be no literature which offers reasonable explanations as to how these variables impact upon fruit and vegetable consumption.

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[8] Canned, bottled, frozen and other vegetable products
[9] Fruit juices and other fruit products

2.3 Fruit and vegetable consumption behaviour

Why people choose and eat the foods they do has been the focus of much research in recent years. This question has been approached from many different perspectives, as evidenced by the range of books relating to food emerging from disciplines such as psychology (Capaldi, 1996; Logue, 1991; Lyman, 1989), sociology (Mennell et al, 1992; Murcott, 1983), consumer behaviour (Marshall, 1994) and cultural studies (Lupton, 1996). It is clear from the literature that food is eaten for a variety of reasons; obviously there are physiological needs that have to be fulfilled for survival, but there are other non-biogenic motivations driving consumption of foods (Maslow, 1970). Foods are eaten for comfort, for the social status attached, as well as for the sense of belonging from eating within a group setting (Lupton, 1996) or sense of heritage (Prentice, 1993). It appears that the goals of consumption can vary widely, as can the range of factors influencing consumption.

The following section reviews the key theoretical perspectives used to date in exploring food choice, and in particular fruit and vegetable choice. The research approaches available are evaluated, especially those based on attitude theory, followed by a detailed discussion of the main factors influencing fruit and vegetable consumption.

2.3.1 Theoretical perspectives in consumer behaviour

The study of consumer behaviour has evolved from an early emphasis on the consumer as a rational being (drawing largely on microeconomics), via a focus on seemingly 'irrational' behaviour (the focus of the motivation research popular in the 1950s and 1960s), through to the prevailing paradigm of consumer behaviour up to the 1980s, where the consumer was largely assumed to be an information processor (Belk, 1995; Holbrook and Hirschman, 1982). The information-processing approach led to the development of logical flow models of consumer behaviour, which became the norm in the way consumer behaviour was researched and taught. Because of its importance in consumer behaviour, a discussion of the information processing perspective is presented, followed by a review of the alternative perspectives, and a discussion of their complementary characteristics.

2.3.1.1 The information processing perspective

The information processing perspective was the dominant paradigm directing consumer behaviour research until the mid 1980s (Belk, 1995). The information processing model regards the consumer as a logical thinker, who solves problems to make purchasing decisions (Holbrook and Hirschman, 1982). The consumer is thought to go through three main stages prior to consumption. The consumer first recognises the need for a product, then undertakes a search for information about that product. After evaluating the alternatives available, a purchasing or consumption decision is made. Post-purchase evaluation of the purchase is believed to occur after the purchase has been made. If the consumer is satisfied with the product purchase, then the consumer will rebuy the product in future, leading to the creation of product or brand loyalty.

While the information processing approach has been widely described in consumer behaviour text-books, it is difficult to find consumption behaviours that fit this process (East, 1997). This information processing approach has been criticised as being too structured (Hirschman and Holbrook, 1982; Olshavsky and Granbois, 1979) and for not taking into account the level of involvement a consumer may have with the purchase. Howard and Sheth (1969) tried to overcome this apparent neglect of involvement, by introducing the continuum of problem solving, ranging from extended problem solving through to routinised problem solving. According to Howard and Sheth, the more involved the consumer is with the consumption behaviour, the more effort s/he will spend at each stage of the decision making process. For a routine problem-solving situation (or habitual behaviour), the consumer may not go through all stages of the decision making process, as they may already have information about the alternatives available to them, or have established previously the choice criteria upon which a decision is based (Schiffman and Kanuk, 1997). However, the problem solving view of the consumer implies the consumer has gone through the stages of the decision making process at some point.

Olshavsky and Granbois (1979) argued against this approach, relating the information processing approach to the nature of motivation driving the consumption behaviour. Categorising motivations into hedonic (relating to the senses), symbolic meaning (ego-involvement) and in terms of functional performance, Olshavsky and Granbois (1979) suggest that the information processing perspective is only really relevant where the product satisfies functional motivations. Food consumption can be for the satisfaction of hedonic, symbolic or functional motivations. Where functional motivations are being satisfied, it may be the case that the information processing approach is useful to explain food purchasing and consumption.

The systematic approach suggested by the information processing perspective may go some way to explaining most food choice behaviour, in that consumers will have gone through the process at some point. However, consumption aimed at satisfying hedonic and symbolic motivations (often apparently 'irrational' consumption behaviour) are not explained by the information processing approach. A greater insight may be offered by an understanding of the symbolic and hedonic nature of consumption.

The interpretivist or experiential approach to consumer behaviour focuses on the role of symbolic meaning to consumption emphasising hedonic responses and aesthetic criteria.

2.3.1.2 Experiential consumption

The experiential, or interpretivist, perspective on consumer behaviour focuses on the consumer's experience of consumption. Hirschman and Holbrook (1982) describe experiential, or hedonic, consumption as "those facets of consumer behaviour that relate to the multisensory, fantasy and emotive aspects of product usage experience", and emphasise that a complete understanding of consumer behaviour must include attention to the experiential aspect of consumption. Within this perspective, the focus is on the role of affect, symbolism, meanings and feelings of consumer behaviour, e.g. Prentice (1996). Research approaches for studying experiential consumption tend towards interpretivist methods where understanding, rather than prediction, is of importance.

The work of Holbrook and Hirschman focuses mainly on products or services which have an obvious 'fun' dimension, e.g. certain leisure pursuits or types of tourism, with experiential consumption argued to be either hedonic or symbolic (Prentice, 1996). However, Levy (1959) argued that all products, even the mundane, may have some symbolic meaning.

Gofton (1989) described the importance of understanding the symbolism associated with food, arguing for an improved understanding of not just what the meanings attached to food may be, but also why symbolic structures are as they are. Keane and Willets (1994) support this, suggesting an understanding of symbolism in food is necessary to improve eating habits.

Hedonic motivation can be defined as that which appeals to the senses, but within consumer behaviour literature, hedonic motivation also embodies the emotional aspects of consumption. An approach which can incorporate both these types of motivations would be useful to improve understanding of food, and fruit and vegetable, choice.

2.3.1.3 Incorporating the social dimension

Both these approaches (the information processing and the experiential) have provided great insights into consumer behaviour concerning products and services. There are aspects from each which may be useful to improving understanding of food choice in general and fruit and vegetable choice in particular. It seems that both these perspectives offer something of value, and no one need be favoured (Schiffman and Kanuk, 1997). However, a criticism of each of these perspectives is that little consideration appears to be given to the social aspects of consumption. Two main strands to the direction of consumer behaviour research which incorporates the social dimension have emerged since the early 1980s.

The first approach is that of the critical theorists (Ozanne and Murray, 1996), where researchers have studied the link between the individual and society. The focus is on the consumer engaging in a social activity, and the critical theory approach seeks to understand the consumer in their consuming culture. East (1997) suggests that this is a useful approach as it moves away from the cognitive model (which he believes has been over emphasised) and the critical theory approach stresses the cultural meaning associated with consumption. However, the critical theory approach has not been widely used in consumer behaviour research, and this may be because the shift away from the individual implies attitudes and motivations are not important, and are therefore excluded from these studies. This minimises its usefulness for the study of fruit and vegetable consumption, as it tilts the balance too far away from the individual, providing little or no insights into influences acting at an individual level.

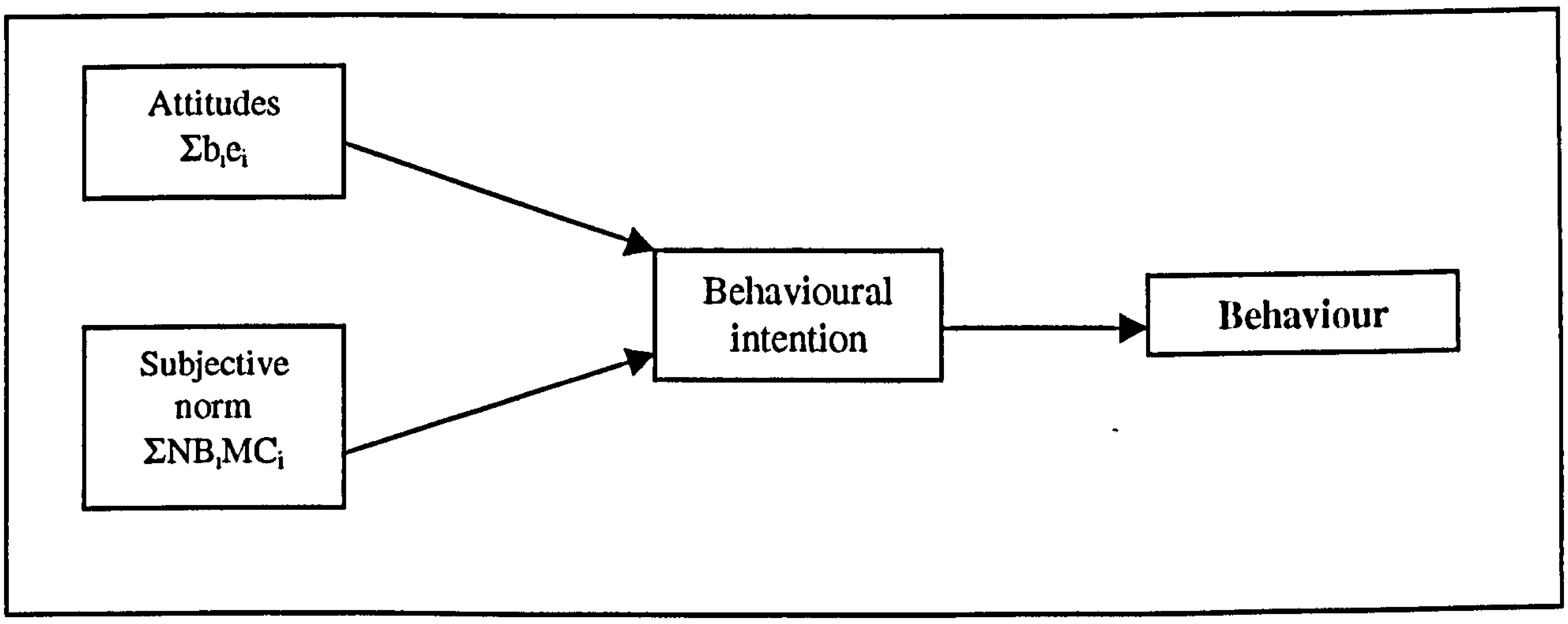
The second approach to incorporating social aspects of consumption behaviour emerges from social psychology and is widely represented in consumer behaviour by theories of the relationship between attitudes and behaviour. Most research into attitude theory takes as its base the Theory of Reasoned Action, developed by Fishbein and Azjen in 1975. This model, provides an approach to examining the relationship between attitudes and behaviour, while incorporating a social dimension. This attitude model, and variations of it, have been widely applied in consumer behaviour and social psychology, and in particular have been applied to the study of food choice behaviour.

2.3.1.4 Attitude theories of consumer behaviour

In 1975, Fishbein and Ajzen introduced the Theory of Reasoned Action, which forms the basis of most models of attitudes and, thus, attitude research. Such models are variously referred to as expectancy-value models, multi-attribute attitude models and Fishbein models.

Fishbein and Ajzen (1975) hypothesised that behaviour was determined by intent, which in turn was determined by one's *attitude* (overall evaluation of performing a behaviour) and *subjective norm* about the behaviour (the evaluation of significant others' beliefs about performing a behaviour). The Theory of Reasoned Action suggests that the cause of volitional behaviour is one's intention to engage in that behaviour, with intention representing the individual's motivation to perform the behaviour. *Behavioural intention* mediates between *attitude* and *behaviour*. Within this framework, *attitudes* are an individual's overall evaluation of the various beliefs about a concept (Peter and Olson, 1996). However, behavioural intention (or motivation to engage in the behaviour) is also influenced by the individual's evaluation of the beliefs of significant others. Specifically, this is represented by *the subjective norm* construct, which represents perceptions of specific significant others' preferences as to whether one should or should not engage in the behaviour. The Theory of Reasoned Action is presented diagrammatically in Figure 2.1.

Figure 2.1 The Theory of Reasoned Action



Attitude towards the behaviour (or consumption) is a function of an individual's beliefs regarding outcomes of the behaviour, and evaluations of the outcome. The attitude score is given by summation of an individual's beliefs about consequences of this act (*b*) and evaluation of those consequences (*e*). *Subjective norm* comprises of beliefs as to whether important others' think the individual should engage in the behaviour or not (*NB*), and motivation to comply (*MC*) with their preferences. This provides a measure of the behavioural intention to perform the behaviour.

The Theory of Reasoned Action does not subscribe to the view that human behaviour is controlled by unconscious motives or overpowering desire. According to Ajzen and Fishbein (1980), people consider the implications of their actions before they decide to engage in a behaviour or not. An individual's *intentions* to perform is viewed within the Theory of Reasoned Action as the immediate determinant of actual behaviour.

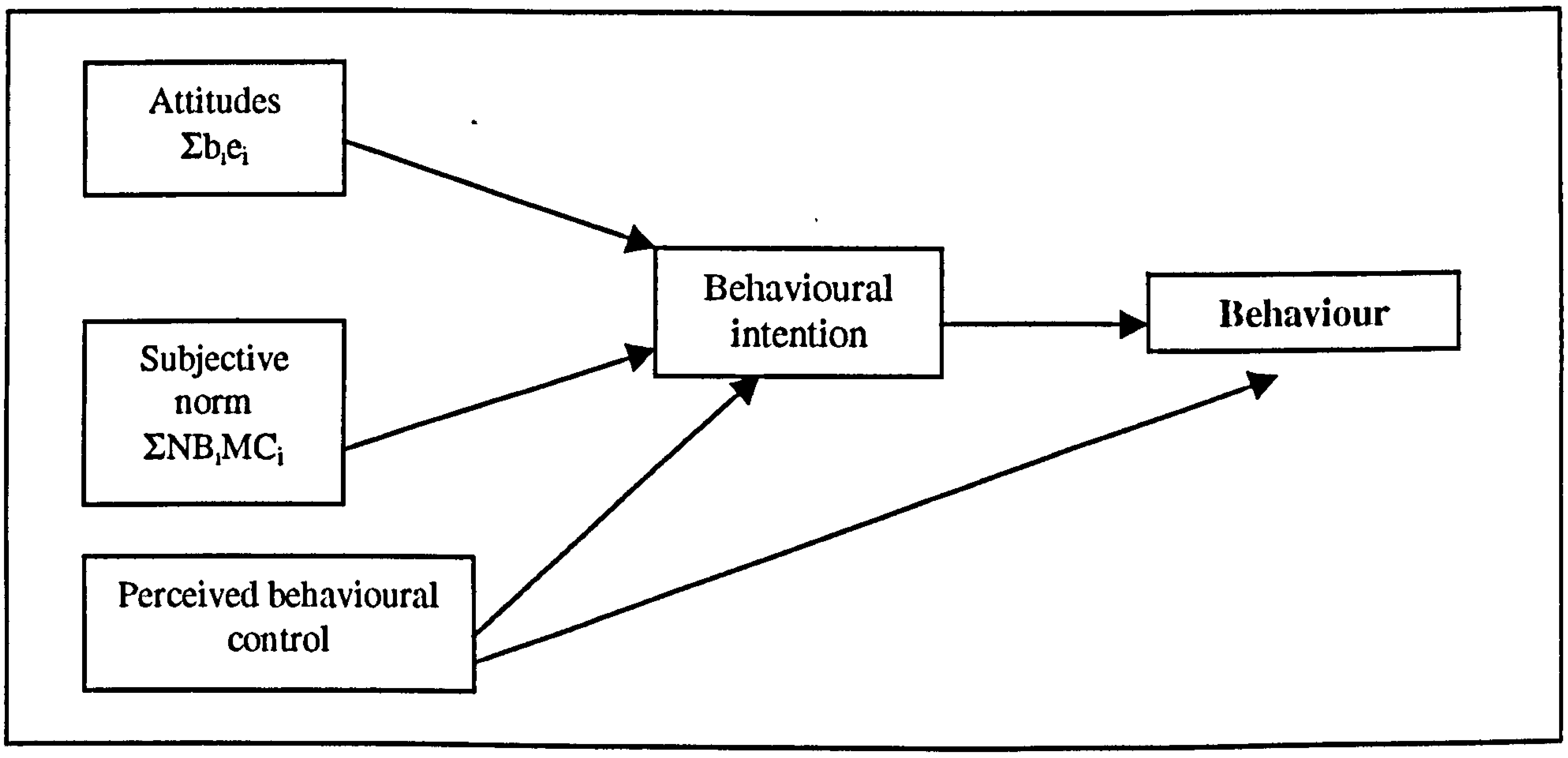
The Theory of Reasoned Action provides a view of the consumer/individual which has as its aim explanation and prediction of behaviour, incorporating a social dimension, as well as the individual's beliefs. The Theory of Reasoned Action was introduced to explain behaviour thought to be under the *volitional control* of the individual; i.e. the individual has made a conscious decision to act, and believes the behaviour is within his or her control. Fishbein and Stasson (1990) describe volitional control as being 'no impediments to the execution of that behaviour'. Within the Theory of Reasoned Action, volition is operationalised by the *behavioural intention* measure, i.e. the likelihood one would intend to perform the behaviour. This variable intention is in evidence in the main models of consumer behaviour: Engel, Blackwell and Miniard (1968) link attitudes to behaviour via intention, as does the Howard and Sheth (1969) model.

The problem with these conceptualisations is that while the relationship between the constructs within the Theory of Reasoned Action is contingent (i.e. attitude does not invariably lead to intent), there is no indication of what these contingencies might be. How attitudes and intentions are linked, and how intentions and action are linked is not specified within the attitude theories. Ajzen and Fishbein (1977) went some way to resolving this issue by saying that only when action, time, context and target are specified will there be correspondence between the measures within their model. A behaviour must be completely under a person's control if the person can decide at will to perform it or not. Conversely, the more that performance is contingent on the presence of appropriate opportunities or possession of adequate resources (time, money, etc) the less the behaviour is under volitional control (and hence the weaker is likely to be the link between attitude and action).

The emphasis on behaviours within volitional control is at the heart of the main criticism levelled at the Theory of Reasoned Action; situational factors are not considered. Related to this is the notion of unforeseen circumstances. Actions that are at least in part determined by factors beyond the individual's control fall outside the boundaries of the model (Ajzen, 1988; Sheppard et al, 1988). Many factors may interfere with control over intended behaviour, some of which are internal to the individual and some which are external. These may include skills, abilities, knowledge (internal) and time, opportunity and dependence on others (external). Because volition is central to the Theory of Reasoned Action, then impulse and irrational behaviour are not accounted for or explained.

To address the range of behaviours where volitional control is not exercised, Ajzen (1988) introduced the Theory of Planned Behaviour, identical to the Theory of Reasoned Action, but for the inclusion of the *perceived behavioural control* construct. This is conceptualised as the "person's belief as to how easy or difficult performance of the behaviour is likely to be" (Ajzen and Madden, 1986). The Theory of Planned Behaviour is shown in Figure 2.2.

Figure 2.2: The Theory of Planned Behaviour



The Theory of Planned Behaviour addresses one of the fundamental problems with the Theory of Reasoned Action: by including perceived control, Ajzen (1985) believed that the predictive power of the model could be increased. *Perceived behavioural control* relates to an individual's beliefs about their ability to conduct the behaviour, and theoretically incorporates unforeseen circumstances, which may intervene between behavioural intention formation and execution of the behaviour. The addition of *perceived behavioural control* introduces some relationship to the outside world, acknowledging that this has an effect because of the way individuals perceive their control over a behaviour. Where people are assessing their environmental situation well, the more closely does the *perceived behavioural control* correspond to actual control, and higher predictive power of the model is expected.

Perceived behavioural control has motivational implications for intentions about the behaviour. Even if one has a positive attitude towards a behaviour and it is positively evaluated by others, when an individual believes they do not have the ability to conduct the behaviour (either external or internal influences) they will not form an intention to engage in the behaviour (Ajzen, 1988). If someone intends to behave in a particular way their behaviour may be inhibited by factors outwith their control. Hence, *perceived behavioural control* has a direct influence on intention.

The direct path from perceived behavioural control to behaviour (not mediated through intention) represents the actual control the individual has over the behaviour, i.e. is a non-volitional influence (Bagozzi and Kimmel, 1995). Perceived behavioural control can be used to predict behaviour, without causal influence being established, because it "may be considered a partial substitute for a measure of actual control" (Ajzen, 1988: 134). With the addition of the perceived behavioural control, The Theory of Planned Behaviour is better at explaining attitudes, and represents an improvement on the predictive ability of the Theory of Reasoned Action (East, 1997).

Applications of the Theory of Planned Behaviour in consumer behaviour have been summarised by East (1997) and include a wide range of subject areas from physical exercise (Ajzen and Driver, 1992) through problem or addictive behaviours (Morojele and Stephenson, 1992; Devires and Backbier, 1994; Schlegl, Devernas and Zanna, 1992) to more consumption related behaviours such as recycling (Boldero, 1995) and gift buying (Netemeyer, Andrews and Durvasual, 1993). The Theory of Planned Behaviour has been popular in studies of health-related behaviours, as evidenced by the work of Conner and Norman (1996).

2.3.1.5 Attitude studies in food research

More specifically relevant to this research are attitude studies within food choice. There have been studies on food choice which have not formally used the Theories of Reasoned Action or Planned Behaviour. These studies of food choice and attitudes have tended to use a wide definition of attitudes, focusing on the beliefs which constitute overall evaluations, rather than formal models of attitudes. Examples of such work include Fearne's (1992) study of attitudes towards potatoes, and Anderson et al's (1994b) study of fruit and vegetable consumption. Stafleu et al's (1994) work on high and low fat foods used global attitudinal measures rather than the components of attitude described in the Theory of Reasoned Action or Theory of Planned Behaviour. The outcome or results of these studies tended to be expressed in terms of the beliefs strongly associated with the behaviour.

More common are food choice research studies, where either the Theory of Reasoned Action or Theory of Planned Behaviour have been formally tested. Examination of the predictive ability of the components of the Theory of Planned Behaviour on intention and behaviour provides some interesting insights into the effectiveness of such an approach. Paisley et al (1995) discovered subjective norms to be the most important predictor of intentions to reduce fat intake; this remained the case when those with a low fat diet were considered alone. When those with a high fat diet (actual and perceived) were considered alone, attitude became the best predictor of intention. For both those with low intake and high intakes of fat, perceived behavioural control was a poor indicator of intention. Similarly, Nguyen et al (1996) found subjective norm to be an important predictor of intention to adopt a low fat diet, with the same subjects scoring higher on perceived behavioural control.

In a study of intentions to drink non-sugared mineral water, Astrom and Rice (1996) showed that intention was primarily predicted by perceived control and attitudes, while subjective norm had less impact. For this study, intention alone was the immediate determinant to behaviour, suggesting this behaviour was within participants' volitional control (i.e. their actual control closely correlated with their perceived control). Attitudes and behaviour towards six food groups were examined in a study of Swedish children's breakfast consumption by Gummesson et al (1997). Intentions to consume the food groups were predicted by attitudes, and in some cases subjective norm. Perceived behavioural control was a poorer predictor, significant in only one of the six foods.

Dennison and Shepherd (1995) studied adolescent food choice, adding measures of self-identity, dietary restraint and the perceived behaviour of others as potential predictors of intention. This study found both perceived behavioural control and attitudes to be good predictors of intentions; while subjective norm itself had little impact on prediction, the addition of the measure of perception of friends' behaviour had a significant impact. This unusual finding may highlight problems attached with the subjective norm measure as operationalised by the Theory of Planned Behaviour.

There have been a few studies which have focused on attitudes and fruit and vegetable choice. Anderson has been involved in two major studies of fruit and vegetable consumption, one in Scotland (1994), and the other in sites in Glasgow and Reading (1997). In this work there has been progressively greater emphasis on attitudes, in particular using the Theory of Planned Behaviour as a theoretical base (Cox et al, 1997). In the earlier Scottish study only a weak correlation was found between attitudes towards eating fruit and vegetables and behaviour, suggesting misconceptions about the extent of consumption and how it fitted in with a 'healthy diet' (this study did not use the Theory of Planned Behaviour formally, although it did discuss responses in terms of attitudes and motivations). The focus of the reported findings was very much on the beliefs towards the kinds of food, as opposed to attitudes studied within a formal theoretical framework (as noted above, a fairly common feature of much of the work on attitudes to foods).

Brug et al (1997) have explored fruit and vegetable intake in the Netherlands. Self-efficacy expectations (a similar construct to *perceived behavioural control* from the Theory of Planned Behaviour) and attitudes significantly correlated with the consumption of fruit, salads and cooked vegetables, suggesting this construct (perceived behaviour control / self-efficacy) is an important influence on fruit and vegetable consumption.

Attitude models have been used fairly consistently over the last decade in food research studies. While attitudes appear to be fairly good at predicting intentions to consume certain foods, the explanations offered for the consumption behaviour are ambiguous. The preceding discussion of a sample of studies which have applied the Theory of Planned Behaviour or Theory of Reasoned Action, suggest that the nature of the interaction between components of the models (especially the subjective norm and perceived behavioural control), and their relationship to behavioural intention, is inconsistent. The support for *perceived behavioural control* and *subjective norm* as predictors of behaviour is mixed, with no clear pattern emerging as to which is more relevant or significant a predictor of behaviour.

2.3.1.6 Limitations of the Theory of Reasoned Action and Theory of Planned Behaviour

The discussion of studies applying the Theories of Reasoned Action and Planned Behaviour suggest that these models are better at prediction of behaviour, rather than explanation. It seems from the literature that these theories show correlations with behaviour, but do not show how causative links (if any) work. However, attempts at improving the predictive power of the theories also appear to result in a greater explanatory ability of the theories. For example, in the studies where greater predictive power was achieved (e.g. Dennison and Shepherd, 1995) the researchers incorporated other measures, which were particularly relevant for either the food group or else subject group. While it is not clear whether these extensions represent enduring additions to the Theory of Planned Behaviour, there have been efforts to systematically incorporate such extensions to the study of different food choice situations, e.g. self-identity in adolescents (Dennison and Shepherd, 1995).

The second limitation with these models lies in the definitions used. For the studies described, each showed the dimension labelled 'attitudes' to be a predictor of behaviour; the Theory of

Planned Behaviour does assume that 'attitudes towards behaviour' is a relevant operationalisation of motivations to consume. 'Attitudes' may be an inappropriate term to describe what is essentially motivation (Schiffman and Kanuk, 1997). The term 'attitude' implies involvement with the behaviour. Within food choice this may not be useful; some consumer behaviour researchers believe food purchasing and consumption to be a low involvement behaviour (Foxall and Goldsmith, 1994). That is, the consumer may not have any great strength of feeling for the food purchase or consumption, despite strength of feeling being a prerequisite for the attitude, as measured in Theory of Planned Behaviour, to be a meaningful construct (Ajzen, 1988). Attitudes, as defined earlier, are a product of beliefs about the behaviour and the individual's evaluation of those beliefs. *Modal salient beliefs* are those beliefs most associated with the behaviour, providing an indication of importance of the belief to the individual (Ajzen, 1988). Due to the nature of the food choice and purchase (described, above, as perhaps a low involvement behaviour), other situational factors may have more (or the most) impact on behaviour and hence need to be explored at the same level.

The incorporation of the perceived behavioural control item forms the basis of the third concern with the Theory of Planned Behaviour. The main aim of adapting the Theory of Reasoned Action to include the perceived behaviour control dimension was to "take into account some of the realistic constraints that may exist" (Ajzen, 1988: 133). This was assumed to be key to increasing the predictive and explanatory power of the theory. Consideration of the above studies suggests that perceived behavioural control is not such an important predictor of intention. However, the studies reported focused mainly on predicting *intentions* to perform a behaviour; few of the studies provide indications of the influence of each of the components on *behaviour.*

It might also be argued that the *perceived behavioural control* dimension introduced by Ajzen (1988) does not go far enough in embracing the range of influences (constraints and facilitators) which may intervene between intention formation (motivation or commitment to act) and action. With the focus on formation of intention to consume, little credence is given to situational factors influencing the individual, with the term *perceived behavioural control* designed to capture all possible impediments to action. The all encompassing nature, and non-specificity, of the perceived behavioural control terms could arguably contribute to explaining its limited predictive ability. Situational factors are recognised as a key influence in consumption behaviour (Belk, 1975), possibly intervening between intentions and action. As such, influences and processes leading from intention to behavioural performance are excluded from this model.

2.3.1.7 Goal Directed Behaviour

Bagozzi has proposed various theoretical frameworks that directly address some of the limitations of the Theory of Planned Behaviour (Bagozzi and Kimmel, 1995; Bagozzi 1993; Bagozzi and Warshaw, 1990). Bagozzi (1993) focuses on goal directed behaviours and the role of volitions (i.e. the perceived ability to achieve, willpower, determination). While the emphasis of many of the studies applying the Theory of Reasoned Action and Theory of Planned Behaviour was on understanding formation of attitudes, Bagozzi (1993) has shifted the emphasis to understanding the process between behavioural intention (commitment to goal pursuit) to behaviour (enactment of goal).

Action is the "bodily movements one makes to achieve an end or purpose" (Bagozzi, 1993). These actions are in response to either reasoned or unreasoned processes (motivational or cognitive) that are fulfilled through some end or achievement. Whether or not these motivational or cognitive processes result in action depends very much on the individual's volitional control, which is the equivalent of *behavioural intention* from the Theory of Planned Behaviour.

In order to explore the relationship between attitude and choice and intentions and action, Bagozzi (1993) proposes a model of volitions, usefully defining them as the "cognitive and motivational processes that follow a plan to pursue a goal or perform an action". Goals are the sought-after results of motivated behaviour (Schiffman and Kanuk, 1997). Any behaviour which is subject to impediments (i.e. factors that get in the way of realising the behaviour) may be considered as goals (Bagozzi and Warshaw, 1990). Intermediate goal-directed behaviours are problematic actions needed to achieve a desired end state (e.g. eating fruit and vegetables for long term health). Consequence-based goal directed behaviours are actions sought as ends in themselves. An example may be eating certain foods for the pleasure derived from actual consumption.

The form of these impediments (which the consumer perceives as standing in his or her way of realising the behaviour) can be broadly classified as scarce supply, scarce resources, trying to complete a consumption within a specified time period and lack of willpower or unconscious habits (Bagozzi and Warshaw, 1990). Bagozzi and Warshaw suggest that, due to these intervening factors, there is a case for consideration of the additional factors intervening between intent and performance. Specifically, Bagozzi and Warshaw (1990) state that this is due to the degree of conscious control the individual believes he or she possesses, and the degree to which the individual tries to achieve their goal. Effort is conceptualised as 'trying' in this model, and replaces behaviour as the dependent variable of Theory of Reasoned Action.

By aiming to understand individual's goals and the means chosen to achieve them, a closer understanding of uncertain consequences or outcomes may be achieved, i.e. why behaviours are not performed even when the intent to perform that behaviour exists. This framework is particularly useful as it acknowledges that there are impediments or barriers to behaviour performance, making action problematic. With the emphasis on constraints and facilitators, the focus of attitude theory is repositioned from explaining attitudes to understanding the intervening factors influencing the process from motivation to act (behavioural intention) to action (behaviour).

To achieve a better understanding of fruit and vegetable consumption, it would be useful to identify the goals of consumption, and the important intervening factors influencing consumption. The next section examines the literature on fruit and vegetable consumption, with a view to identifying the range of constraints and facilitators of fruit and vegetable consumption.

2.4 Constraints and facilitators of fruit and vegetable consumption

Since the early 1990s, a considerable body of work has emerged which has considered various aspects of fruit and vegetable consumption. Some of this work has already examined causal relationships between key individual characteristics (such as sex and age) and fruit and vegetable consumption, but more recently has embraced psychosocial influences on consumption. The examination of the literature takes the form of the broad consumer behaviour model outlined in Kotler et al (1996) as a guiding framework for organisation. Hence, influences on the consumer will be organised into internal, external and marketing influences. The framework proposed by Shepherd (1990) for examining food choice behaviour, which focuses on the individual and his or her relationship with the food itself and the environment, broadly resembles the current framework. The main difference lies in the terms used, and the inclusion of marketing influences as central to the chosen approach. The detailed discussion of the influences on fruit and vegetable consumption follows.

2.4.1 External influences

2.4.1.1 Social class / occupational status

Social class has consistently emerged as an important influence in studies considering variations in diet. The measures of social class used in food choice studies vary (e.g. income level, OPCS and JICNARS), reflecting the inherent difficulty in measuring social class. Often occupation alone is taken as a proxy measure of social class due to relative ease of measurement (Foxall and Goldsmith, 1994). Whatever approach is used to measure social class, it has become clear from the studies of diet and social class that those experiencing social disadvantage (i.e. low income earners, C2DE JICNARS groups and IV, V, VI OPCS groups) tend to have lower fruit and vegetable intake (Anderson et al, 1994; Bingham et al 1989; RUHBC, 1992; MAFF, 1994, 1995, 1996; Shepherd, et al, 1996; Neumarksztainer, et al, 1996). Low fruit and vegetable consumption appears to be just one of the characteristics of the overall poorer diet of those on low incomes. Although Marshall et al (1995) describe the drop in price of fruit and vegetables in real terms in recent years, Leather (1995) argues that when considered in terms of energy provided per pence, then fruit and vegetables are not good value for money for 'filling up' at low cost, compared to other less healthy alternatives such as frozen chips, mince pies and full fat milk. For families on low income, food expenditure is limited, and foods chosen are likely to be those which are filling, and not perceived as wasteful (Leather, 1992). For many in this situation, fruit and vegetables are not a priority.

In a study of socio-economic status and food choice, Gerhardy et al (1995) found household composition to be an important criteria for segmenting according to food consumption. However, they also conclude that for fruit and vegetable consumption social class is a relevant indicator of consumption.

2.4.1.2 Geographical location and cultural influences

Forsyth et al (1994) explained variations in composition and quality of diet, in terms of geographical factors, inextricably linked to social class factors. In their Glasgow study, they showed the 'socially advantaged' areas consistently exhibited healthier eating patterns than the least 'socially advantaged'; they suggested, however, that socio-economic and socio-demographic factors do not perhaps entirely explain these variations. In areas where residents are healthier, wealthier, have better access to healthy foods, and are more 'culturally receptive to a healthy diet', a greater demand for these foods is created, in turn enhancing availability and lowering prices. Areas vary in the provision of affordable and nutritious foods, argued by Macintyre et al (1993) to impact upon the health of those living in an area.

2.4.1.3 Family

Another important influence on food choice is the role of the family; there may be variations in fruit and vegetable consumption with particular stages of the family life cycle. Ritson and Hutchins (1991) found 'older' households tend to depend less on frozen and processed vegetables than other family types (particularly households with young children), perhaps reflecting lower uptake of technological changes such as use of freezers, microwaves, etc or more time for preparation of fresh produce. The higher consumption of fresh vegetable and fruit among the older population is supported by MAFF (1996). National Food Survey data (MAFF, 1996, shown in Table 2.) also shows that as the number of children in a household increase, the average consumption of fruit and vegetables is likely to be reduced.

Food consumption in the family is subject to taste/preference vagaries within the family. Fruit and vegetable consumption appears to be affected by this. Kerr and Charles (1986) described situations where there was a hierarchy of status within families, with food purchased reflecting the tastes of those higher in the hierarchy. Men and children largely influenced food choice behaviour; the mother's personal preferences were not a priority. Fruit and vegetable consumption has been shown to be influenced by the preferences of children and partners (Kilcast et al, 1996; Marshall et al, 1995), with children exerting control over family vegetable consumption. The key influences on children's food preferences appear to be perceived sweetness (Oram, 1994), exposure and familiarity (Birch and Marlin, 1982) and mode of preparation (Domel et al, 1993). Given the nature of children's role in influencing consumption of fruit and vegetables within the family, understanding children's preferences may be an important route to increasing fruit and vegetable consumption amongst adults (as well as children).

Family 'connectedness' is an important factor in influencing fruit and vegetable choice among adolescents (Neumarksztainer et al, 1996); those who feel their family cares and understands them have higher fruit and vegetable consumption than those who score low on such measures.

2.4.1.4 Meal structures and food habits

Another important socio-cultural influence on fruit and vegetable consumption appears to be the current accepted meal habits within a society or culture. Anderson et al (1994b) reported the very specific correlations between vegetable consumption and other food items, illustrating, for example, that vegetables are acceptable with chicken but not with sausage rolls. This is an important point, as its suggests that in order to influence consumption of one food group, the whole diet has to be addressed.

Other recent developments in food habits have been the increase in snacking behaviour in recent years (Traill, 1994; Anderson, 1994b) and also the shift towards greater reliance on fast-foods (Ritson and Hutchins, 1990). The appropriateness and acceptability of fruit as a snack has been explored in a few studies (Jack et al, 1997; Marshall et al, 1994), with the overall finding that the suitability of fruit as snack depends on the needs that the fruit consumption is satisfying. Both the studies conducted by Jack et al (1997) and Marshall et al (1994) found fruit was not generally perceived as filling, but Jack et al (1997) found fruit was perceived to be healthy and refreshing, satisfying a different need.

2.4.2 Internal influences

2.4.2.1 Personal characteristics

Various demographic variables have been shown to influence fruit and vegetable consumption levels. Smokers have lower fruit and vegetable intake, than non-smokers (Thompson et al, 1992; Anderson et al, 1994a); women tend to have higher consumption of fruit and vegetables than men (RUHBC, 1992; Anderson et al, 1994a; Smith et al, 1992 Baranowski et al, 1993); and lower age groups tend to have lower consumption than middle or older age groups (MAFF, 1996; Scottish Health Survey, 1995). Education levels also influence fruit and vegetable intake (Laforge, 1995; Subar et al, 1994), with those with higher levels of education consuming greater amounts of fruit and vegetables.

2.4.2.2 Physiological consequences

Baranowski et al (1993) reported children's immediate negative expectancies of increased fruit and vegetable consumption, as mainly physiological, such as increased bowel movements and wind. Similarly, Cole-Hamilton et al (1986) found some participants had difficulty adjusting to the extra bulk associated with a diet rich in fruit and vegetables.

Another important physiological response to consumption is that of satiety. Sensory specific satiety is the decrease in desire for a specific food after eating it (Lyman, 1989), and is most common for foods with the same sensory characteristics. If several foods are offered in succession which differ in taste, appearance and texture, more will be consumed in a meal than if only one food is given, even if that single food is the favourite (Rolls et al, 1981). While not addressed specifically within fruit and vegetable research, it would follow that if one large portion of one vegetable (or even two similar types of vegetables) are offered, then this is likely to reduce further desire for consumption of that food.

2.4.2.3 Attitudes, beliefs and motivational influences

A number of studies and reports have suggested attitudinal and motivational factors are among the most substantial barriers to fruit and vegetable consumption (Anderson et al 1994a; SOHHD, 1993). Anderson et al (1994a) conclude that motivational factors (which they define as 'dietary beliefs, values and overall attitudes') are the greatest barriers to change in fruit and vegetable consumption in Scotland. Within the area of fruit and vegetable choice, there are a few studies which have addressed these attitudinal and motivational influences on consumption (often referred to as psychosocial factors).

As discussed earlier, attitudes are the evaluation of relevant beliefs about a specific behaviour; as such, many studies in the food choice (and fruit and vegetable choice) literature designed to study attitudes, focus on salient beliefs as well as the relationship between attitude and behaviour. Fearne (1992) studied beliefs and perceptions about potatoes, finding the perceived versatility of potatoes to be the most important attribute influencing consumption. This was followed by beliefs about healthy eating, and then those relating to convenience. Other research has stressed the importance of understanding the mechanism by which beliefs about the body and health relate to attitudes and motivation to change fruit and vegetable consumption behaviour (Backett, et al 1992; Goode et al, 1996). General beliefs related to food choice, which may be relevant, were examined by Hayes and Ross (1987). They suggested that while *health beliefs* are a major motivating factor in preventive health behaviour, in certain preventive health behaviours (in particular eating habits) *concern with appearance* is as significant a motivating factor.

In an attempt to effectively target low fruit and vegetable consumers, Laforge et al (1995) compared 'stage of readiness to change' (from the Prochaska and DiClemente's (1986) Transtheoretical Stage of Change model) with self-reported behaviour. The basic premise of Stage of Change model is that behavioural change occurs when individuals have made decisions to make changes. There is a continuum of stages an individual may go through before a behaviour is successfully adopted (precontemplation through to maintenance). At each stage the individual has different priorities, and these can be assessed through the individuals' 'decisional balance'. LaForge (1995) developed logistic regression models of low consumers and of individuals in the precontemplative stage (i.e. no intention of changing in the next six months), to compare characteristics of these groups of individuals. This study found 'precontemplators' shared similar characteristics to the low fruit and vegetable consumers, i.e. low consumers were typically male and had an education of less than 13 years. The presence of children at home had a further negative effect on consumption of fruit and vegetables (as might be expected from the preceding discussion). While characterisation of high and low consumers is useful and interesting, the focus of this study was on socio-demographic variables only, thus providing little insight into attitudes or motivations of either precontemplators or low consumers.

In a study of fruit and vegetable eating habits in the Netherlands, Brug et al (1995) found self-efficacy (similar to perceived behavioural control) to be the strongest correlate of intent for consumption of fruit, salads and boiled vegetables. Attitudes were a good predictor of intention to eat these fruit and vegetables, although not as great as self-efficacy. Similarly social influences were important predictors of fruit and vegetable intake. Brug et al (1995) suggest that the unexplained variance in fruit and vegetable consumption behaviour may be attributable to habit or prior behaviour.

There appears to be a discrepancy, among consumers, between health beliefs and actual fruit and vegetable intake, exemplified in the Anderson et al (1994b) study, where Scots eating some fruit and vegetables (perhaps <2 portions per day) considered this to be in line with a healthy diet. Related to this, is the issue of how much fruit and vegetables people think they are eating, and how this related to their lack of knowledge over what constitutes a portion. Cox et al (1997) found beliefs about actual behaviour (i.e. consumption) to be a very important factor in explaining consumption levels. Subjects (in the *contemplative* stage of increasing fruit and vegetable intake, from the Stage of Change model) tended to underestimate their intake in grams (even when consuming 5 portions). This is in contrast to the study by Brug et al (1997) who suggest subjects are over estimating consumption levels, although it is not clear why this is the case. Added to this, Brug et al (1997) found the theoretical determinants of behaviour (e.g. self-efficacy, social norms, etc.) predicted better this self-reported behaviour than the actual behaviour of subjects (Brug et al, 1997; Lechner et al, 1997).

While knowledge about what constitutes a portion may inhibit consumption of fruit and vegetable, lack of knowledge about the benefits of fruit and vegetables for health can also be a barrier to consumption (Dittus et al, 1995). Another barrier found by the same study was an inability to prepare fruits and vegetables.

Affect, or preference, was the most important predictor of fruit and vegetable consumption amongst school children (Domel et al, 1996) in a study which included self efficacy and outcome expectations measures. The model had weak explanatory power (only 13% of variance was explained by this model), but it does show how children's tastes and choices are influenced by 'liking'.

Preferences for other foods can also conspire against fruit and vegetable consumption; such preferences for other foods was found to be an important barrier to increased fruit and vegetable consumption amongst low income women (Treiman et al, 1996). Other barriers included time and effort to prepare fruit and vegetables (as suggested by Johns, 1992).

2.4.3 Marketing influences

The last category of influences is that of marketing influences (Kotler et al, 1996). This particular group of environmental influences are organised around the marketing mix, i.e. they relate to the price of fruit and vegetables, their promotion, packaging and place or distribution.

A Keynote (1993) report on the UK fruit and vegetable market documents an increase in popularity of easy to use fruit and vegetables. Sales of leafy salads, bananas, grapes and stone fruit are all increasing, while oranges, pears and apples show decreasing sales. It is those varieties of fruit and vegetables which are perceived to be interesting and convenient which are undergoing growth. The more traditional varieties remain unpopular. Leather (1995) states that in real terms the market for fruit and vegetables is increasing in value, but decreasing in volume, i.e. the more expensive items are popular, but not the cheaper produce. The argument is put forward by Leather that in terms of calorific energy, fruit and vegetables are a more expensive source of energy than other foods, thus leading to their relative low intake by individuals with constrained financial ability. Further, the convenience aspect of fruit and vegetables is inextricably linked to cultural elements such as meal structures, usage and context, as well as the fashion of modern cuisine. Money available was reported as a constraint on consumption by Marshall et al (1995).

Jeffrey et al (1994) intervened in a cafeteria setting to decrease the *price* of fruit and salads, measuring the impact on consumption levels. Fruit and salad purchases increased 3-fold in the intervention period; post-intervention levels of consumption fell to close to pre-intervention levels (although marginally higher). While this increased consumption did not produce long term effects, it does suggest that consumption of fruit and vegetables is susceptible to environmental/marketing influences, such as price.

Lack of availability has emerged in various studies as an important barrier to increased fruit and vegetable consumption, which is linked to socio-economic status. Adoption of a healthy diet in the West of Scotland was found to be more expensive in less wealthy areas (Sooman et al, 1993), and while mean price of fruit and vegetables was slightly lower in such areas, quality and availability were considerably poorer than in advantaged areas. In a recent US study, Treiman et al (1996) found availability along with time and effort, was one of the most important barriers to increased consumption of fruit and vegetables. Lower income families are often less mobile, due to financial restrictions, and are thus dependent on small local shops where the range of fresh produce is smaller and the prices higher than in out-of-town supermarkets (Henson, 1992; Forsyth et al, 1994). A greater amount of shopping is done in independent stores in Scotland, compared to the rest of the UK (Anderson et al, 1994b), and the resultant higher prices could explain the lower consumption of fruit and vegetables in Scotland. Anderson et al (1996) point to structural problems relating to availability of good quality produce in deprived areas and remote rural locations in Scotland. Further, there is still a lack of fruit and vegetable markets in Scottish cities, which reduces availability, competition and hence value for money. Thus the fruit and vegetable retailing structure inherently constrains consumption of fruit and vegetables.

In describing the barriers facing individuals in changing fruit and vegetable consumption, Marshall et al (1994) found that perceptions that frozen and tinned are not as nutritionally good as fresh were prevalent. The implication of such a finding is that if frozen or tinned produce are not perceived to be acceptable, and fresh produce is unavailable then it is highly likely consumption will not occur at all, and some other alternative will be sought.

Studies considering the acceptability of fruit and vegetables *per se* were considered under Section 2.4.1.4. Drewnowski (1996) studied the perceived versatility of vegetables by studying their compatibility for serving and consumption within the same meal. The rationale was to consider the feasibility and acceptability of consuming more than one vegetable at the same meal. Versatility and convenience were strongly associated with preferences. Compatibility between vegetables was influenced by colour contrast, with green and non-green vegetables providing the most acceptable combinations. Hence peas were considered suitable with carrots, but not with spinach. This is interesting as it provides some insight into the guiding principles used by consumers influencing choice over which vegetables to consume. Examining the suitability of combinations of different foods, Anderson et al (1994b) showed positive correlations between fruit and vegetable intake and certain foods (e.g. chicken) and a weak negative correlation with meat products (e.g. sausages, meat pies). Again this provides further insights into some of the choice heuristics guiding fruit and vegetable consumption.

The unfamiliarity of certain vegetables, in particular, was found to constrain trial and choice of less common, exotic vegetables (such as aubergines, parsnips and courgettes) (Piggott et al, 1994).

The role of the media, advertising in particular, in influencing food choice cannot be ignored. Advertising expenditure on fruit and vegetable was £4.5m in 1991, falling to £2.9m in 1993 (Leather, 1995). In 1993, £10m was spent on advertising dietary supplements, and £70m on advertising chocolate. The low values spent in advertising fruit and vegetables is exacerbated by the low branding of fruit and vegetables. Both Marshall et al (1994) and Jack et al (1997) recommend that to increase fruit and vegetable consumption, a much higher profile needs to be conferred upon it. A more easily identifiable brand name is also easier to advertise.

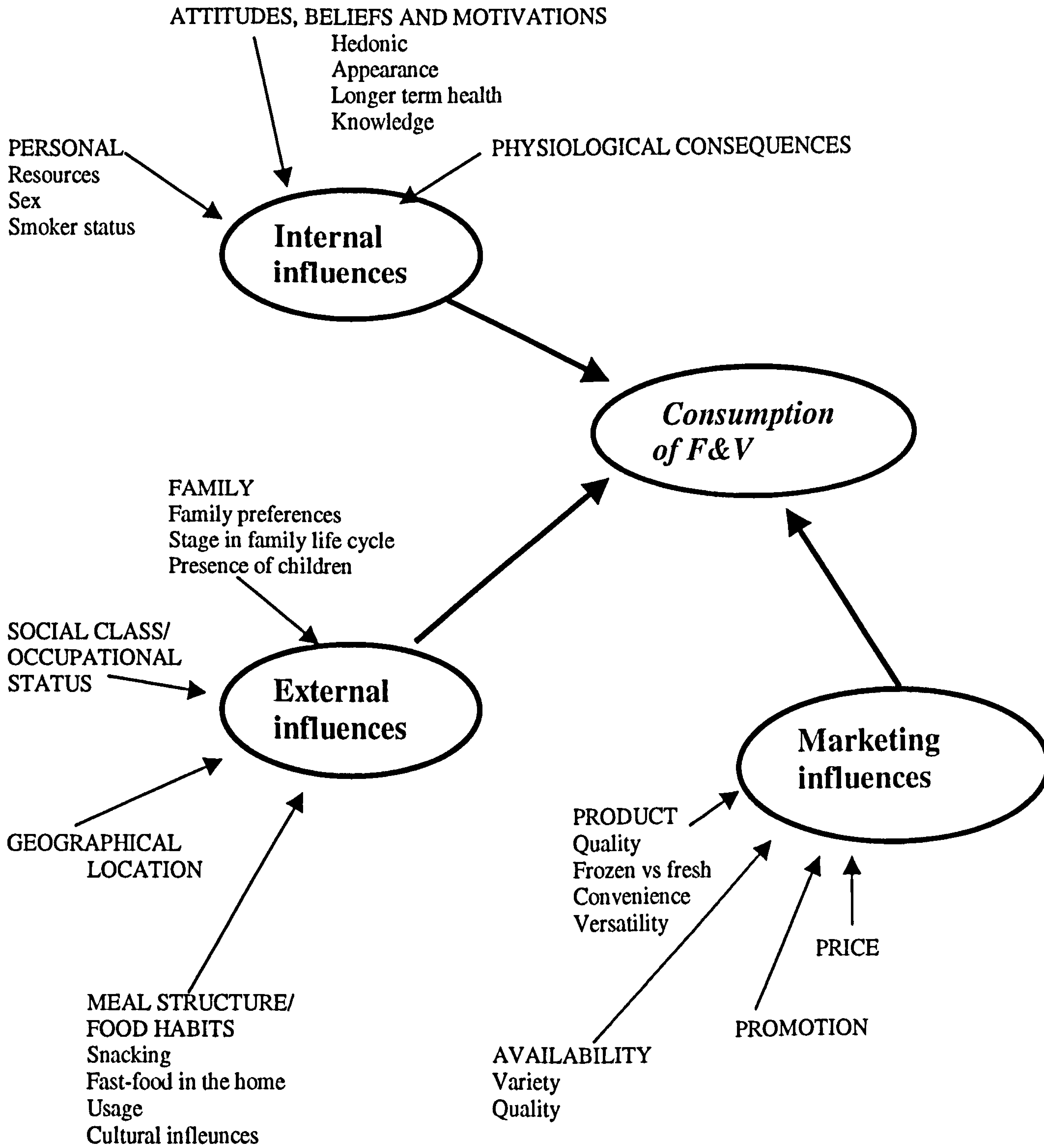
Foerster et al (1995) report on promotional efforts to increase awareness of the '5 a day' message in California, as an impetus to increasing fruit and vegetable intake. Through use of mass media, co-operation between health departments and the produce/supermarket industries and extensive use of point-of purchase messages over a two year period, they tracked (positive) changes in beliefs, knowledge and awareness about cancer and the role of fruit and vegetables Their results suggest an increase in public awareness of the protective effects of fruit and vegetables, but not a change in beliefs related to the quantity of fruit and vegetables to be consumed to afford this protection. This communication based strategy focused on the relationship between fruit and vegetables and cancer, as opposed to specific levels of consumption, which perhaps explains this situation. While communication is important to increase consumption, its relationship to belief formation (an antecedent of attitude and behavioural change) needs further examination.

2.5 Conclusions

The preceding discussion of fruit and vegetable consumption would suggest that this is a fairly complex behaviour; the main influences on fruit and vegetable consumption are represented in Figure 2.3. While it may be fairly straightforward to describe consumers of fruit and vegetables in terms of socio-demographics, it is less clear what motivational factors are influencing consumption. Of particular importance for strategies to increase consumption is to establish the extent to which the influencing variables have a main or interactive effect on fruit and vegetable consumption, i.e. how much is it compounded by the influence of a range of factors? How much variance in consumption can be explained by psychological variables?

It appears that there are many constraints on fruit and vegetable consumption, most notably related to socio-economic status and the areas where people live. Linked to this are financial constraints; for many fruit and vegetables are perceived as costly. Another important constraint appears to be the role of the family, with the aim of the meal provider being satisfaction of individual preferences, rather than consumption of nutritious foods. However, the facilitators of consumption are not so clear. This lack of understanding of what enables consumption is most likely due to a focus in studies on fruit and vegetable consumption on low fruit and vegetable consumers.

Figure 2.3: Fruit and Vegetable Consumption



This review of the literature has shown that there are gaps in the knowledge with regards to fruit and vegetable consumption. Attempts so far to examine fruit and vegetable consumption have been limited, mainly examining those with low fruit and vegetable consumption or examining the behaviour within the framework offered by the attitude models described earlier in this chapter. A shortcoming of many of the studies outlined above, is that a starting point is often assumed where the main facilitator of fruit and vegetable consumption is that individuals are motivated to eat fruit and vegetables largely for health reasons, and therefore the behaviour is explored within this narrow context. An important aspect of food choice, omitted from the attitudinal models, is the experiential or hedonic motivations for consumption. It may be the case that health beliefs are important in influencing fruit and vegetable consumption (as featured in the work of Brug et al, 1995), but fruit and vegetable consumption may be motivated by hedonics (Holbrook and Hirschman, 1982) or by appearance and self-esteem (Hayes and Ross, 1987). Research into this area has to include motivation to consume, as well as other psychological factors. There is also a clear need to incorporate the social influences on fruit and vegetable consumption, such as the influence of the family.

It is also clear from the literature that understanding of the process from motivation or behavioural intention to consumption or behaviour is weak, in general. While studies have looked at the barriers to fruit and vegetable consumption (Cox et al, 1995; Anderson, et al, 1994b), there has been no study which has systematically considered these as intervening variables influencing consumption.

Given these gaps in the literature, the present research focuses on modelling fruit and vegetable consumption. Multivariate approaches (such as discriminant analysis and log linear analysis) are available to establish the most salient variables influencing consumption, which provides the basis of a model of how these variables influence fruit and vegetable consumption behaviour. Understanding non- or low-consumption of fruit and vegetables is central to this thesis; models of low and high fruit and vegetable consumers *per se* may provide some insights into this consumption behaviour. Developing models from a goal directed perspective would also assist in achieving a further understanding of the nature of the influence of these variables/factors, and the process by which they influence consumption. A comparison of important influences for those with a positive behavioural intention to consume fruit/vegetables would provide these insights.

The main research question, then, is '*What are the factors influencing fruit and vegetable consumption, and how might their relationship be modelled?*'.

To answer this it is necessary to first establish the most salient factors influencing consumption of both fruit and vegetables, and then to consider what intervenes between commitment to act and action. This leads to various research questions:

1. What are the important factors influencing fruit and vegetable consumption?
2. How do these factors interact, to influence fruit and vegetable consumption?

It is not possible from the literature discussed to compile a comprehensive list of salient factors influencing fruit and vegetable consumption, in particular the factors which facilitate consumption. Further, it is not clear how consumers and non-consumers of fruit and vegetables differ in terms of the factors, i.e. there is no indication of how these interact to influence behaviour. Lastly, it appears that the framework proposed by Bagozzi (1988) for considering achievement of behaviour, may be a useful starting point for guiding the research, since that framework focuses on the important variables intervening between behavioural intention and behaviour. Studies using the Theory of Planned Behaviour have already suggested that perceived behavioural control (which embodies situational factors influencing behaviour) is fairly important. The goal directed approach would place the focus of the research firmly in the context of exploring these intervening variables enabling or constraining execution of the behaviour (i.e. consumption of fruit and vegetables).

The next chapter considers how the research questions might best be answered. It explains appropriate methodological approaches and outlines the research strategy adopted.

Chapter 3 Research Design

3.1 Introduction and aims of this research

The focus of this research was fruit and vegetable consumption behaviour, and its principal objective was to build a model of this behaviour. A model of fruit and vegetable consumption behaviour would increase understanding and prediction of fruit and vegetable consumption. To date, modelling in food choice studies has drawn largely on the multi-attribute attitude models (based on Fishbein and Ajzen, 1975 and Ajzen, 1988). These attitude models were thought insufficient to explore fully fruit and vegetable consumption, as they do not incorporate a broad enough range of influencing factors on this behaviour, most notably hedonic and symbolic motivations. Further, they do not provide much explanation of the process from behavioural intention to action.

The following research aims were adopted:

1. To obtain a further understanding of the range of important factors influencing fruit and vegetable consumption
2. To determine the nature of the interaction of these factors on fruit and vegetable consumption.
3. To develop models of fruit and vegetable consumption.

3.2 Utility of research in this area

Given the clear benefits to individuals of increased fruit and vegetable intake, it is in the interests of government agencies to instigate increased consumption of this food group. Increasing fruit and vegetable consumption has been the focus of recent initiatives by both health authorities and supermarkets (some of which are discussed in Baxter et al, (1997). However, there has not been a corresponding increase in consumption observed (MAFF, 1996). An understanding of the range of factors influencing fruit and vegetable consumption, and the nature of this influence will assist in devising more effective strategies to increase the consumption of fruit and vegetables. This information would provide guidance as to the most appropriate types of activities required for different subgroups (e.g. advertising vs. in-store demonstrations), and also the nature of these activities (e.g. encouraging cognitive vs. behavioural learning; focus on health or enjoyment).

This increased understanding of fruit and vegetable consumption behaviour could also contribute to the development of a comprehensive model of food choice behaviour. Generic models of food choice would allow explanation and prediction of the choices people make in different circumstances, in relation to different foods (Shepherd and Sparks, 1994). As such, those interested in food choice models recognise that different foods are eaten for different reasons, and there are, therefore, benefits to be achieved through studying consumption of individual foods in depth (Conner, 1993). A systematic approach to studying food choice should reveal commonalities among, and differences between, the consumption behaviour associated with each food group.

3.3 A paradigm for the study

There are two major paradigms for research which are generally used in the social sciences. This is often described as the positivist/phenomenological dichotomy (Easterby-Smith et al, 1991). The positivist approach is traditionally associated with quantitative, deductive methods, and the phenomenological with more qualitative, inductive methods. However, Robson (1993) argues that these methods (qualitative and quantitative) are not mutually exclusive, nor solely applicable to the aforementioned philosophical approaches. Yin (1994) supports this, suggesting both qualitative and quantitative approaches can be used with a positivist or with an interpretivist framework.

In order to produce the most appropriate research design, consideration must be given to the key concerns of each approach. The two paradigms are contrasted in Figure 3.1.

Figure 3.1 Key features of positivist and phenomenological paradigms.

	Positivist	Phenomenological
Basic beliefs	The world is external and objective Observer is independent Science is value-free	The world in socially constructed and subjective Observer is part of the what is observed Science is driven by human interests
Researcher should	Focus on facts Look for causality and fundamental laws Reduce phenomena to simplest elements Formulate hypotheses and then test them	Focus on meanings Try to understand what is happening Look at the totality of each situations Develop ideas through induction from data
Preferred methods include	Operationalising concepts so that they can be measures Taking large samples	Using multiple methods to establish different views of phenomena Small samples investigate in depth or over time

Source: Easterby-Smith et al, 1991

The positivist researcher views reality as objective, something to be measured in a formal manner, using an instrument such as a questionnaire. Conversely, for the phenomenological researcher reality is constructed by the individuals who are participating in the study, and therefore is of a multiple nature (Easterby-Smith et al, 1991).

Other differences exist between the two paradigms, as shown above, but perhaps the greatest lies in the methodological processes associated with each. The positivist approach is usually deductive (Gill and Johnson, 1991), with the main concern being deduction from the general to the particular, e.g. food choice theory would inform fruit and vegetable choice in particular. With such a deductive approach, hypotheses and variables are determined *a priori* and remain fixed throughout the study (Cresswell, 1994).

The phenomenological approach is inductive by nature, where theories, hypotheses and categories are the outcome of observation, emerging *from* the data (Gill and Johnson, 1991). When generalisability is the aim, the information from the study is often verified through 'triangulation' with different methods, or among different techniques (Easterby-Smith et al, 1991).

Choice of paradigm very much depends on the nature of the research question. For positivist designs, the problem emerges from the literature, where a substantial body of literature exists already. Theory testing would fall into this category. The phenomenological approach is more relevant when little information exists already, or there is insufficient theory to explain a phenomenon (Easterby-Smith, et al, 1991). In many such studies a theory base does not guide the research.

Returning to the research question of the present study, in choosing a paradigm it seems appropriate to ask questions about the nature of the research problem, particularly 'how much is already known?' and 'which theories are appropriate to study the problem?'.

In addressing the extent of knowledge surrounding fruit and vegetable consumption, the main conclusion drawn from Chapter 2 was that a number of researchers have studied fruit and vegetable consumption behaviour, and established a range of factors constraining consumption. In particular, it would appear from the literature that there are regional variations in fruit and vegetable consumption, as well as social class variations. There has been no approach identified in the literature, where 'geographical location' has been incorporated as an important influence on consumption, and consequently variations in important variables have not been addressed in interaction with this variable. Overall, it is still unclear from previous studies into fruit and vegetable consumption the nature of the interaction between important variables influencing consumption, which provides the basis for this research.

Given the nature of the research problem, the review of the theories (section 2.3.1) suggests there is no single clear approach suitable for studying the current research problem. The theories outlined may be useful, but limiting, in that a narrow range of constructs are defined and examined. Bagozzi's Theory of Goal Directed Behaviour (1988) provides a potentially useful framework for examining this behaviour, but still an exploratory study of fruit and vegetable consumption seems essential, which allows a study of the important intervening factors between attitude and action. Variables, or factors, of importance have been established, but not comprehensively within the one study. For example, while there is a clear indication of the role social class plays in influencing fruit and vegetable consumption, how this interacts with other variables is not known.

Thus, this study requires an element of inductive research, to explore the range of important variables within different areas in the UK, and to generate the research hypotheses and questions, to be verified in a deductive phase of the research. However, this work would be best described as quantified description, i.e. the quantitative stage is to model the factors influencing fruit and vegetable consumption, proposed from the qualitative stage. Hence a two-phase approach was chosen for this study, where a qualitative, inductive phase was followed by a quantitative, inductive/deductive stage.

3.4 Methods chosen

For the qualitative research, there were various approaches available to the researcher, such as individual interviews, observations, verbal protocol analysis and group interviews (Robson, 1993; Easterby-Smith et al, 1991). With the aim being to explore the range of influences on fruit and vegetable consumption and to gain some insight into the nature of the influences, an in-depth, unstructured approach was desirable (Green et al, 1988). Focus groups were chosen, as they have the advantages of the individual interview (probing, etc), while 'snowballing' which arises in the group context, broadens the discussion further than the researcher's or the single individual's perspective (Krueger, 1995).

Data collection methods available to the social scientific quantitative researcher include such methods as experiments, quasi-experiments, surveys, content analysis, archival research and case studies. Experiments involve measuring the effects of manipulating one variable on another variable most often with the allocation of samples to different experimental conditions (Robson, 1993). The variation between the groups would be created by the researcher. A survey approach would not create the variation, but find a 'naturally occurring' variation, and examine, and compare, individuals or groups at different levels of this variation (DeVaus, 1996). Since variations in fruit and vegetable consumption are 'naturally occurring', it seems appropriate to adopt the survey methodology to explore fruit and vegetable consumption behaviour. An overview of the approaches chosen is given below.

3.5 Research design

3.5.1 Overview of the qualitative study (Stage 1)

The aim of the focus group discussions was to gain a closer understanding of the factors influencing fruit and vegetable consumption. The literature review had given a framework of factors which could be explored, but the purpose of the focus groups was to further extend this framework, establish salient constraints and facilitators to fruit and vegetable consumption, and to obtain some insight into the way in which these factors impact upon fruit and vegetable consumption.

Individual, external and marketing influences on fruit and vegetables were elicited. Focus groups were useful in this context, since they provide more than attitudes and opinions in relation to fruit and vegetable consumption. While attitudes towards consuming fruit and vegetables may be useful, this study was particularly concerned with the full range of influences which assist and prevent consumption. For instance, individuals may have a 'strong' attitude towards consuming fruit and vegetables (i.e. think it is very good to eat more fruit and vegetables), and may even have a strong intention to eat, but the manifestation of this behaviour may be prevented by a host of other factors intervening at the individual level.

It has been argued that the use of focus groups in market research studies is limited by the nature of the 'focal' concept, e.g. brand choice, brand usage, product attributes. Templeton (1987) believes the negligible importance such concepts display for ordinary people, makes them unsuitable for study at this deeper level. This was not considered such a great concern for this study, since the focus of the research was a generic food group (as opposed to a branded product), for which consumption of, and beliefs about, reflect the perspectives individuals have of their world (e.g. associations with health, caring for family, providing, etc.). Morgan (1988) argued that a focus on individuals' experiences and perspectives was more useful as data than opinions, since these experiences tend to draw on the wider context of behaviour. Hence, an emphasis on perspectives was important.

3.5.2 Overview of the survey (Stage 2)

The objective of this stage in the research was to develop a model of the relationships between the factors influencing fruit and vegetable consumption. Building on data from the qualitative stage, the survey provided data which was then analysed to provide a model of fruit and vegetable consumption.

The survey was conducted using a structured questionnaire, ensuring the same information was collected consistently for all participants in each location. A structured approach also simplified analysis, with coding being fairly straightforward (DeVaus, 1996; Hague, 1993)

Two main approaches to questionnaire design can be taken: a descriptive survey or an analytic, relational survey. Descriptive surveys are useful if answering 'how many' type question, their purpose being to count (Oppenheim, 1992). The chief concern of this type of survey is to describe how many of a population or sample have a certain characteristic, or how often certain events occur together, i.e. association (Robson, 1993). Descriptive surveys are not designed to explain events or to show causal relationships.

Analytic, relational surveys are used to explore the associations between particular variables (also commonly referred to as explanatory design (DeVaus, 1996)). Analytic surveys follow a correlational design and use retrospective control through statistical manipulation (Oppenheim, 1992). This approach is less oriented towards representativeness and more towards finding associations and explanations, and more likely to ask why and what goes with what. Analytical surveys are particularly useful for exploring and establishing multi-causal models (i.e. one where there are many factors influencing the dependant variable, and perhaps one another) (DeVaus, 1996).

In deciding which type of analytic approach to take there were two main issues. Firstly, it was necessary to establish how much was already known about the main causal variables and processes in the chosen area (Oppenheim, 1992). The second issue was establishing the level of control the researcher had over events.

As discussed in Section 3.4, a considerable number of variables, influencing fruit and vegetable consumption, appear to have been identified (Cox et al, 1995; Brug, et al, 1995; Anderson, et al, 1994a). However, the nature of their relationship to each other and to fruit and vegetables is less clear.

The second issue it that of control over events, by the researcher. Areas of study were chosen deliberately, to reflect different levels of high and low fruit and vegetable consumption, and different social class profiles. However it was less straightforward for the researcher to control for knowledge about fruit and vegetables or beliefs about benefits, and for this reason control was seen as limited.

When control is limited, but there is a fair amount of knowledge about the research problem of interest, Oppenheim (1992) advises a multivariate design as the most appropriate.

Taking such an approach has implications for the statistical analysis used. With a multivariate design it is possible to formulate hypotheses and distinguish between the dependent variable and the independent, controlled and uncontrolled variables. Designs featuring complex multivariate analyses can help to disaggregate the variance (Oppenheim, 1992). Assumptions of such a design are that there is no proof of causality, and direction and sequence of causality often remain uncertain because design is basically cross-sectional.

3.6 Development of models

The desired output from this research was a model of fruit and vegetable consumption. Model building is an important process for obtaining an adequate understanding of the phenomenon under study (Oumlil and Balloun, 1990), in this case fruit and vegetable consumption. A model is essentially a representation of the phenomenon in terms of the variables, in the simplest, or most parsimonious, form. Rice (1993) describes models in consumer behaviour as representations which aim to provide a 'simplified portrayal of consumer processes to aid description, explanation and control of buying behaviour'. The key to this process of model development is the use of multivariate statistics, which allow the researcher to consider the impact of two or more variables simultaneously. Thus, it is possible to consider how variables, or factors, interact to influence the dependent variable, namely fruit and vegetable consumption.

Guiding the development of multivariate models should be a conceptual model of the phenomenon. The conceptual model can be a simple representation of the relationships to be explored, for instance the conceptualisation of the factors influencing fruit and vegetable consumption, Figure 2.3. Working from such a framework implies a modelling approach where variables are included in the analysis for a reason, and is similar to hypothesis testing of the positivist paradigm. Adopting such an approach avoids the indiscriminate inclusion of variables, where the multivariate technique is left to sort out relevant variables (Hair et al, 1995). While there is a danger of omitting relevant independent or predictor variables, inclusion of irrelevant variables could produce an over-fitted model, which has little generalisable ability (Tabachnik, and Fidell, 1996). The framework guiding the model building, and the nature of the variables themselves, should assist in decision making regarding variables for inclusion in the model.

An analysis plan should be developed in advance of data collection and model building, where issues of sample size, types of variables, and type of modelling methods are considered.

There are two main approaches available to the researcher for modelling multivariate data: non-parametric (for modelling categorical or ordinal data) and parametric (for continuous or interval data), the more frequently used approach.

Within the current research, it was clear from an early point, that categorical variables, such as place and social class, would be important influences on fruit and vegetable consumption and would thus need to be included. Interval data, such as attitude and belief scores, would also be relevant to the present study. The dependent variable was fruit and vegetable consumption and, as discussed in detail in Chapter 5, this was categorical in nature. For this reason, multivariate techniques were required, which were appropriate to these data.

The main multivariate modelling techniques used were log linear modelling, logistic regression and discriminant analysis.

3.6.1 Log linear modelling

Log-linear modelling is a non-parametric multivariate technique, which has as its aim the elucidation of relationships among non-parametric variables in a multi-way cross-tabulation (Knoke and Burke, 1980). Loglinear models are similar to multiple regression models, except their use is suitable for categorical and ordinal data (Norusis, 1993). Whenever there is a data set where both the dependent variables and the independent variables are categorical, log-linear modelling is a useful technique. Log-linear modelling allows the researcher to explore the multivariate nature of the relationship between variables, normally only possible when the assumptions for parametric multivariate analysis are met.

To obtain a log linear model, the natural logs of the cell frequencies, rather than actual counts, are used. Modelling is in terms of associations among the variables and marginal frequencies (Ishii-Kuntz, 1994). To interpret loglinear parameters, 'odds' and 'odds ratios' are used. An 'odds ratio' is the ratio between the frequency of being in one category of a variable and the frequency of not being in that category of the variable (Jobber, 1994). Log linear modelling is discussed in more detail in Chapter 6.

Log linear models for contingency tables do not distinguish between dependent and independent variables, treating all variables in the same way, mainly useful for uncovering underlying structures between variables. Logit models (a special class of log linear models) describe how a binary response depends on a set of independent variables. This is appropriate when considering the relationship between consumption level and the other variables present (Agresti, 1996). The logit is the log of the odds of being in one rather than another category of a dependent variable (DeMaris, 1991). Logit models take this as the response, which is then modelled as an additive function of several independent variables.

3.6.2 Logistic regression

Logistic regression is a modelling approach that is best used to describe the relationship between several continuous independent variables and a dichotomous dependent variable (Kleinbaum, 1994). Logistic regression is an alternative form of regression where the dependent variable is of a non-metric nature (Menard, 1995). While discriminant analysis is also an appropriate multivariate technique, when the dependent variable is of a non-metric nature, the advantage of applying the logistic regression techniques is that the strict assumptions of multivariate normality do not have to be met (Hair et al, 1995)

While multiple regression is appropriate to predict the value of a metric dependent variable from a set of independent variables, logistic regression analysis differs in that it does not predict whether an event occurred or not, but instead predicts the *probability* of an event occurring (Hair et al, 1995). Thus it is called a linear probability model (Aldrich and Nelson, 1984).

The logistic regression techniques uses the 'odds ratio', similar to log liner modelling, comparing the probability of an event occurring with that of it not occurring.

3.6.3 Discriminant analysis

Discriminant analysis is a procedure which allows investigation of differences between groups, handling many independent variables simultaneously (Klecka, 1980). It is a multivariate analysis technique which allows examination of a categorical dependent variable (e.g. fruit consumption classified as high or low) and several independent metric variables (e.g. measures of attitudes, opinions, motivations relating to fruit consumption). Categorical variables can be included, as independent variables, in a discriminant analysis if recoded into dummy variables (Hair et al, 1995: 248), hence enabling inclusion of the socio-demographic variables of this study.

The major purpose of discriminant analysis is to predict group membership from a set of variables (i.e. socio-demographics and latent attitude, opinion and beliefs). The primary goals of the discriminant analysis are to find the dimensions along which groups differ (explanation), and to find classification functions to predict group membership (prediction) (Hair et al, 1995).

Discriminant analysis is similar to multivariate regression analysis, but differs in that the dependent variable is categorical. The other main difference between discriminant analysis and other multivariate techniques lies with its ability to ascertain group membership.

When the variables of interest are categorical, then log linear modelling is the appropriate multivariate technique. When the dependent variable alone is categorical, discriminant analysis or logistic regression are commonly used, a choice being made on the basis of how well the data fit the assumptions of multivariate normality (Hair et al, 1995).

3.7 Structure of the research

The study proceeded as follows:

> Stage 1 – Qualitative study, using focus groups, to explore the range of influences on fruit and vegetable consumption, and develop a framework of fruit and vegetable consumption. This is reported in Chapter 4.
>
> Stage 2 – A quantitative survey, where the framework from Stage 1 was tested to establish models of fruit and vegetable consumption, using a variety of statistical modelling approaches. This is reported in Chapters 5, 6 and 7.

The following chapter describes the qualitative stage of the study in detail, presenting the results and conceptualisation of the factors influencing fruit and vegetable consumption, which forms the basis for the survey, described in Chapter 5.

Chapter 4 Focus group methodology and results

4.1 Introduction

This chapter describes the qualitative stage of the study (Stage 1), and its implications for the research as a whole. Focus groups were the chosen qualitative methodology. This chapter discusses in detail the focus group methodology, arguing its suitability in this context. Findings from this stage are then presented and discussed in light of the literature review. Finally the framework which emerged from Chapter 2 is expanded to embrace these findings.

4.2 The purpose of the focus groups

In broad terms the focus groups were concerned with exploring the full range of factors influencing fruit and vegetable consumption. The main purpose of this part of the research was to achieve a closer understanding of the factors influencing fruit and vegetable consumption, and consequently advance the framework developed from the literature. This would then form the basis of the survey stage of the research.

4.3 Research Method

4.3.1 Definition and background

This stage of the research was concerned with elucidating the key factors influencing fruit and vegetable consumption. Focus groups were selected as an appropriate methodology as they involve an in-depth unstructured approach, which is most suitable for gaining insights into underlying motivations and beliefs regarding fruit and vegetable consumption behaviour. The 'snowballing' which characterises such focus groups, broadens the discussion further than the researcher's or any individual participant's worldview (Morgan, 1988).

Focus groups are discussion-based group interviews, which take the form of loosely structured 'steered' interviews (Easterby-Smith et al, 1991). The key feature of the focus group discussion is the interaction between the participants, in response to a set of topics or themes supplied by the moderator or researcher (i.e. it is not simply the researcher asking questions and each participant answering in turn) (Morgan,1988). The discussion most often starts with a general discussion, and then is focused onto the topic of interest to the research (hence the name). A qualitative approach, the focus group is concerned with why participants think as they do, with the main aim of focus group research being 'to get closer to participants' understanding of certain issues' (Millward, 1997).

The focus group methodology has its roots in sociology, and has been previously used extensively in exploratory work in the fields of marketing and consumer research, as well as in health promotion and nutrition related research (Millward, 1997; Brug et al, 1995). Typically focus groups were associated with convenience, which has recently lead to an association with marketing. In this context the emphasis was usually on client satisfaction, as opposed to methodological or theoretical development. The method was relatively neglected as a serious qualitative research tool by sociologists and social psychologists, who tended to favour individual interviews and participant observation methods. Krueger (1995) describes how previously academics avoided the use of focus group since they felt the interaction between the participant was a form of 'respondent contamination'. More recently, with increased exposure to the method (led by researchers such as Morgan and Krueger), academics have come to accept the method for the important insights offered by the group interaction, as well as the valuable information it produces.

4.3.2 Focus groups compared to other qualitative methods

Basically the focus group method is more controlled than participant observation, whilst because of the participant defined nature of the group interaction, it is less controlled than individual interviewing (Dillon et al, 1994). Focus groups are particularly useful when the researcher is interested in the experiences and perspectives of the participants, rather than just in eliciting attitudes and opinions. Focusing on experiences leads to a lively group dynamic - people are more likely to happily discuss their experience than challenge another's opinion (Morgan, 1988), increasing the validity of their response, and therefore, participation. Attitudes and opinions are often seen as small discrete parts of a person's thinking; the use of perspectives implies a broader basis for specific attitudes and opinions, making them preferable. This emphasis on experiences and perspectives allows us to establish not only what people think about the topic, but also why they think as they do.

The role of the focus group research can be exploratory, informing other stages of research (as is often observed in marketing), but equally it can be used in its own right, as a self-contained piece of inquiry (Sampson, 1986). This approach is increasingly becoming more popular, particularly in the social sciences (Kitzinger, 1995).

4.3.3 Approaches to focus groups, and their uses.

Calder (1977) delineates three major approaches to qualitative research, applicable to the focus group methodology. The first is *exploratory*, and essentially takes one of two forms. Researchers may be interested in pilot-testing aspects of anticipated quantitative research, e.g. the wording of items in an interview schedule or a product concept. This is fairly straightforward, and in this form the method represents a cost-effective evaluation tool for market researchers (Kinnear and Taylor, 1996). Alternatively, the researcher may wish to generate hypotheses and insights about a new topic, or from a new study population, which would then be verified, or validated, with future quantitative research (Sampson, 1986). This is the approach taken by many social science researchers. Here, focus groups are used for construct generation, with the rationale being that consideration of the problem in everyday language will facilitate a subsequent study.

The second qualitative research approach proposed by Calder is the *clinical* approach. Considered more scientific in style, Calder also refers to the clinical approach as quasi-scientific. Its basic premise is that the everyday language expressed in discussion conceals underlying thoughts and beliefs, which can only be revealed through the sensitivity and 'clinical judgement' of a specially trained analyst. It is scientific in that it represents a deductive approach, i.e. interpretation of the everyday language is based on valid scientific knowledge and theories.

Within marketing, it was used extensively in motivation research, where the information generated from the discussion was used for 'clinical judgement', by the researcher (Calder 1997). Problems emerge when discussions are based around a specific theory, since interpretation is confined to the limits of that theory (Morgan, 1998). For example, if the Theory of Planned Behaviour was used as the basis of the research, then the researcher would generate the most salient beliefs, evaluations, normative beliefs, etc. in relation to the application of interest. In such a situation it is unclear how the researcher deals with unexpected constructs (Easterby-Smith et al, 1991) not included in the chosen theory. The clinical research approach can be useful where perhaps much is already known about the subject, or there is a strong theoretical base for analysis. However, it is not a suitable approach when a relatively new topic is being explored.

The third approach to analysis of focus groups is a *phenomenological* approach, where the aim is to understand the experiences and everyday knowledge of the consumer. Based on sociological phenomenology, it is the description of how individuals interpret reality in their own terms, in contrast to the scientific, theoretical interpretations from the clinical approach. A characteristic of phenomenological research is the interactive, personal contact of the researcher, similar to participant observation, and it is the approach adopted by most sociological studies using the method. It is essentially an inductive approach (Easterby-Smith, et al, 1991).

In marketing research studies, a description of the approach adopted is rarely provided. Focus groups are frequently used in new product development, for both idea generation and in evaluation of new (or modified) product concepts (loosely clinical approach, but also could be exploratory) (Marshall, 1995). Another frequent use in marketing research is in developing interview schedules or questionnaires, often providing the language used for construction of the questionnaire (exploratory). The focus group method is commonly used in an exploratory way, as a provisional or preliminary stage to a quantitative stage (such as a questionnaire), or even post-quantitative research, where participants' interpretations of results from earlier studies are investigated, a form of triangulation (Miles and Huberman, 1994). The use of focus groups from a phenomenological perspective is less obvious. While phenomenological studies are common in consumer behaviour research, there is a tendency for such studies to focus on the individual consumer (as witnessed in Hirschman, 1985). However, the aim of many apparently exploratory studies in marketing, as well as in health and social research, is to get closer to participants' understanding and experiences of the topic of interest, a definition which places it within the realm of phenomenology. Many focus groups are used to get a general feel for people's perceptions about a subject.

In conclusion, while there are potentially three different philosophical approaches to the focus group methodology, it seems that in practice the approach taken is often a combination of these, particularly exploratory and phenomenological. This does not necessarily lead to the verdict that they are incorrectly used. Rather, as long as the researcher is clear of the aims and objectives of the piece of research, as well as the purpose of each approach, then a hybrid approach is acceptable (Calder, 1977). While these approaches and uses of qualitative research are not exclusive to the focus group methodology, there are specific advantages and reasons for using the focus group methodology over other qualitative methods. Through discussion of the strengths and weaknesses of the method, these will become apparent.

4.3.4 Strengths and weaknesses of focus groups

The main strength of the focus group methodology relates to the nature of the group interaction. The methodology provides the opportunity to collect data from group interactions, material that might not emerge from either the participants' own casual conversations, or in response to the researcher's preconceived questions (Morgan, 1988). Views, opinions, perspectives and experiences on or about a variety of issues are determined not just by individual deliberation, but through discussion with others (Millward, 1997). This is sometimes referred to as the 'snowballing' effect (Kinnear and Taylor, 1996).

However, as individuals express themselves or relate their stories and experiences, they are exposing themselves to the attitudes, experiences, views and beliefs of the other participants. Studies in group dynamics suggest the group interaction will have a major influence on the resulting 'view'. Bristol and Fern (1993) questioned the ability of focus groups to uncover attitudes, opinions and beliefs, discussing the potential problem of attitude polarisation emerging within the group. The presence of others may lead to individuals focusing attention on their own thoughts and feelings, leading to increased self-awareness and possibly resulting in their adoption of a more extreme attitude position than previously held. This polarisation is likely to be greater the more people present in the discussion. The status of other groups members also has an impact (Latane and Nida, 1980), with more extreme stances being adopted under pressure of normative influences or compliance (i.e. the desire to be favourably evaluated by others can influence individuals to adopt a more extreme position than the group norm). The final explanation for attitude polarisation lies with the 'persuasive-argument' theory (Kaplan, 1987) which posits that the exchange of information in groups can lead members to consider facts that they had not previously considered when forming their attitudes. This could actually lead to attitude change, especially when attitudes are weak.

Attitude polarisation is a concern. However, as Bristol and Fern (1993) point out, it is a shift in degree but not in direction of the attitude that occurs. This may present a problem for research using focus groups as a stand-alone piece of work, especially if findings are extrapolated to a wider population. However, this does not represent that great a problem in the present study, since what is of interest is the range of views expressed. The strength of those views, while clearly of interest to the research objectives overall, is not the focus of this stage of the research. Assuming the group is steered to the 'why' of their beliefs, views and attitudes, this is not really a problem. Finally, the issues associated with attitude polarisation within the group, support an emphasis on experiences and perspectives, thus avoiding the question of the extent to which the attitude being explored belongs to the group or the individual.

The effects of social impact and social comparison are difficult to establish, but the effects can be reduced by ensuring a) the groups have no more than about eight participants, and b) all respondents are from a similar background. The persuasive-argument effect could also be present, but is partly reduced by the recommendation of Morgan (1988) that the topic of the research should be of interest and relevance to the participants. Another approach to validating the results would be to compare results and outcomes from other qualitative studies to verify the constructs and experiences emerging.

An associated problem, expressed by Morgan (1988), is that of not knowing whether the groups interaction would mirror actual individual behaviour. This raises the question 'who's view is expressed?', particularly with internalisation of views and beliefs a common characteristic of the mechanism of group influence (Peter and Olson, 1996). The researcher has to be clear as to whether he or she is interested in collective group experiences (where there is consensus between the individual participants) or individual experiences. This issue is directly related to the methodological approach being taken. Within the exploratory approach, this is an irrelevance, since the concern is generating hypotheses and constructs for further study. What is of relevance, perhaps, is how frequently similar perspectives or views emerge, but as Calder (1977) points out, 'the exploratory approach is meant to be a precursor to scientific knowledge'. For the phenomenological approach, the nature of the view being expressed is a valid concern. However, such an approach is characterised by serial focus groups, with extensive reiteration, feedback, and amending of topic guides as the group discussions progress. This process of reflection and amendment results in the researcher incorporating emerging views and perspectives into subsequent groups, thus addressing the extent to which views are accountable to the individuals within the group, or to the group as a whole. For the clinical approach, with its emphasis on scientific explanation, it is again, perhaps, irrelevant whether the view belongs to the group or the individual. With the emphasis on interpretation of perspectives and experiences it seems that the notion of 'consensus' is irrelevant since uncovering the range of views is the most important issue.

Related to the concept of group interaction is the problem associated with domination of the conversation by one or two individuals (Baranowski et al., 1993), with others being 'silent members' (Marshall, 1995). While this can be problematic (particularly in light of the concerns mentioned above), it is the role of the moderator to facilitate discussion and control for this (Millward, 1997).

Another often-cited strength of the focus group method is that the groups are comparatively easy to conduct, and relatively cheaper than other qualitative methods, and most quantitative methods (Millward, 1997; Kinnear and Taylor, 1996; Morgan, 1988). However, Krueger (1995) points out that the amount of time required for both planning and analysis, as well as the specialist skills required of the moderator, suggests they are neither quick nor cheap, a view based on extensive experience, and observation of studies, using the focus group methodology. Perhaps this view is more of a caution, alerting the potential user to the fact that it is not a 'quick and dirty' method of generating information, but a sophisticated research tool (Millward, 1997).

The flexibility of the approach makes it very attractive (Kinnear and Taylor, 1996; Dillon et al., 1994), especially for exploratory studies. The interviews can produce useful data with relatively little direct input from the researcher (Morgan, 1988). This, however, relates to the problem of the researcher having less control over the data that is generated, than in more structured individual interviews (Morgan, 1988). When there is a need for direct compatibility across groups (for comparison purposes) or when there are a set of clearly predefined issues, there is a need for a more controlled approach, acceptable within the method through the use of structured topic guides (Morgan, 1988). Even within this more structured approach, more complex answers can be provided through probing by the moderator (Kinnear and Taylor, 1996; Dillon et al, 1994).

As the intention of this research was to explore fruit and vegetable consumption, with regard to generating constructs for the quantitative stage, the approach adopted in this study was essentially exploratory, hence the limitations described were not as serious as they might have been for the other uses outlined above.

4.4 The focus group procedure

As outlined earlier, the focus groups were concerned with exploring the full range of factors influencing fruit and vegetable consumption: that is, exploring consumer's experiences and views on consumption and use of fruit and vegetables, from which dimensions would be drawn for wider testing. The main aim of this research was to achieve a closer understanding of the factors influencing fruit and vegetable consumption, and consequently advance the framework developed from the literature review.

In order to achieve this aim, the following objectives were set:

1. To explore the different factors influencing food consumption in general
2. To establish the range of influences on fruit and vegetable consumption.

Factors that appear to largely influence levels of fruit and vegetable consumption are socio-economic background and geographical location (MAFF, 1996; Gregory et al, 1990). In order to establish their impact on fruit and vegetable consumption, the study further aimed to:

3. Compare perspectives of participants from different socio-economic backgrounds
4. Compare views and perspectives of individuals in areas of high and low consumption.

Thus focus groups were conducted with groups of individuals characterising high and low socio-economic status, in areas of high and low consumption.

4.4.1 The research design

4.4.1.1 Participants

A stratified purposive sample was used (Miles and Huberman, 1994). This was one which illustrated subgroups, facilitating comparison between groups. An important characteristic of qualitative research is that choice of participants is driven by some conceptual question, not by a desire for general 'representativeness' (Miles and Huberman, 1994). Thus, groups were selected on the basis of their socio-economic status and geographical location, two variables with strong correlations with fruit and vegetable consumption (MAFF, 1996; Anderson, et al, 1994a; Forsyth et al, 1994).

Within the study locations, focus groups were conducted with individuals in areas characterised by high and low socio-economic status. These areas were selected at a postcode level, using a combination of DEPCAT[1] scores (McLoone, 1991) and census information (OPCS, 1991). Socio-economic status was defined in terms of the OPCS classification[2]. Low socio-economic status was characterised by socio-economic groups IIIM, IV and V, and higher was characterised by groups I, II and IIIN.

Areas of overall high and low consumption were based on National Food Survey data (MAFF, 1994), and areas were chosen that were considerably lower and higher than the average. This became complicated by the fact that, in Scotland, consumption figures are given at a country level, and it was thus difficult to establish levels of consumption at a regional or city level. Using the non-consumption levels of fruit and vegetable intake given by the Scottish Heart Health Study (Crombie et al, 1990; Tunstall-Pedoe et al, 1989), Glasgow was chosen as an area of low consumption in Scotland, and Edinburgh was chosen as an area of higher consumption

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[1] This is a scale of relative deprivation, devised for Scottish post-codes by McLoone, 1991. Each postcode area is designated an score from 1 (least deprived) to 7 (most deprived).

[2] I = professional, II = Managerial and technical , IIINM = Non-manual skilled occupations , IIIM = Manual skilled occupations, IV = partly skilled occupations and V = unskilled occupations. The OPCS was used because it is based on occupational status, and thus relatively easy to make the conversion into the appropriate code, and it is the measure of social class used in most studies of fruit and vegetable consumption in the UK (Anderson et al, 1994a and b; Will et al, 1994).

in Scotland. The rationale was to elicit the broad range of factors influencing fruit and vegetable consumption, at different socio-economic groups and geographic locations. Other recent work, using focus groups to explore eating habits in Scotland, focused on both Glasgow and Edinburgh (Marshall et al, 1995; Will et al, 1994), and it was felt initially that by including Edinburgh in the current study, a broader portrayal of the influences on fruit and vegetable consumption in Scotland would be achieved. To gain some insight into why fruit and vegetable consumption levels in Scotland are so different from those in England, it was desirable to examine the factors influencing consumption in comparable areas in England. Bristol, within the Southwest of England, the area of highest fruit and high vegetable consumption in Britain, was selected as a city within an area of high consumption (from MAFF, 1994 data). Group discussions were conducted in areas associated with high and low socio-economic status Bristol.

Thus focus groups were conducted in Glasgow, Bristol and Edinburgh, with groups in areas associated with high (I, II, IIINM) and low (V, IV, IIIM) socio-economic status. The socio-demographics of each focus group are outlined in Table 4.1.

Table 4.1 Socio-demographic characteristics of focus groups

Area	Socio-economic group	No. of participants	Age group	Sex
Toryglen, Glasgow	IIIM/ IV (Low)	6	18-35	F
Cathcart, Glasgow	II/ IIIN(High)	7	18-45	F
Paisley, Glasgow	II/ IIIN(High)	6	25-45	F
Sighthill, Edinburgh	IV/ V (Low)	6	16-45	F
Lawrence Weston, Bristol	IV/ V (Low)	8	16-45	F
Clifton, Bristol	I/ II (High)	6	25-35	F

Pre-existing groups of individuals were used. There were two main reasons for this. Socio-economic status was important for selection, and it was felt that it may be particularly difficult to access and recruit individuals from the lower socio-economic group. Setting up a group discussion in an unfamiliar setting, with a group of strangers, may have adversely affected the course of the discussion, and for this reason the use of pre-existing groups were thought to overcome these issues. The second main reason pre-existing groups were used was due to the time and financial constraints on the researcher. While some researchers believe it is essential for the flow of the group discussion that participants do not know each other, more recent evidence (Krueger, 1995, Kitzinger, 1995) suggest that this does not represent a major obstacle to the success of the discussion.

Hence, all participants were recruited as pre-existing groups accessed via community centres, pre-school co-ordinators and community health contacts in Glasgow, Edinburgh and Bristol. The participants were individuals responsible for food planning and organising in the 'family unit', and were all female. The discussions took place in the regular meeting place of the group. All discussions were tape recorded, with the permission of the participants.

4.4.1.2 Data gathering

The focus group discussions took place between August and September, 1994, with one meeting per group taking place. While seasonal bias may have occurred, especially with cheaper produce widely available in late summer, the results of the discussions do not support this, suggesting experiences and opinions in relation to fruit and vegetable consumption are deep-rooted and enduring. Seasonality is an issue; there is no way of knowing when bias would be better or worse. More favourable seasonal bias may have been introduced by conducting the discussions earlier in the summer (May, June or July) or in the middle of winter (people longing for the summer and the associated imagery of ripe fruit and vegetables), but equally a negative bias could have been in effect at these times of year.

4.4.1.2.1 The role of the conceptual model

As noted before, the approach to the focus groups was exploratory (Calder, 1977). However, a conceptual framework of factors influencing fruit and vegetable consumption had already been devised as a result of the literature review (Figure 2.3). This was used as a basis for the topic guide for each session. Since the aim of this stage in the research was to expand (or consolidate) this framework, it was important that the researcher did not impose a set of questions on the group which would artificially lead to them discussing only items included in the conceptual framework. For this reason, the groups were allowed to freely discuss their own experiences and perspectives, with respect to the main areas (themes) of the conceptual framework. These were incorporated into a discussion guide (discussed below).

4.4.1.2.2 Focus group protocol

Each group discussion lasted 90-120 minutes, talking place in the regular meeting place of the group. The researcher was the moderator for every focus group discussion (the researcher had gained experience of this methodology whilst an undergraduate student). A set of guidelines were constructed for the researcher to ensure continuity between groups. This topic guide was developed, which purposely outlined key 'themes' to be covered in the course of the discussion, but only in broad terms. Participants were encouraged to talk and relay their experiences as freely as possible; subsidiary questions were on hand to ensure key areas were covered (this protocol was based on Morgan, 1988 and Krueger, 1994). This unstructured approach sufficiently allowed flexibility in the development of the discussion, while ensuring certain topics were covered. The topic guide used is found in Appendix 1.

Each participant taking part in the groups completed a short demographic questionnaire prior to participation to ensure their suitability in the group (although no-one was rejected, since by virtue of being in attendance at the group, in the area, meant they fulfilled the criteria for inclusion). This is also included in Appendix 2.

As well as tape-recording each discussion, notes were also taken after each session on general views, feelings about the dynamics of the group. This was useful for the analysis stage, providing extra insight into the discussions. Each discussion was transcribed verbatim by the researcher. The analysis procedure is outlined below.

4.4.2 The analysis

4.4.2.1 Coding/categorising

Coding was used in the analysis for assigning units of meaning to the information contained in the interview transcripts. Codes were attached to 'chunks' - words, phrases, sentences or whole paragraphs, connected or unconnected to a specific setting (Miles and Huberman, 1994). The codes were used to retrieve and organise the chunks, to give them some meaning within the context. This was done using a standard word processing package (Word).

A coding scheme was created; this was initially devised, prior to the fieldwork, from the conceptual framework and research questions stemming from the literature. While this was useful, it was expanded as the analysis progressed. As new concepts emerged they were appropriately coded and included (Coolican, 1994). This systematic approach to coding, combined with an inductive element, led to a comprehensive coding scheme, which was context-sensitive. This approach is a combination of that deductive method advocated by Miles and Huberman (1994), and the more 'grounded' approach favoured by Glaser and Strauss (1967). Because this coding was deduced from the literature, but also exploratory, it was felt that this synthesis of approaches was appropriate. A full version of the coding scheme is found in Appendix 3. Example of codes expected from the *literature* related to financial constraints (coded 'F') and context of consumption (coded 'Cx'). An example of a construct, or influence, emerging from the *data*, included the distinction, in fruit and vegetable consumption behaviour, found between the weekends and during the week (coded 'WE').

4.4.2.2 Patterning

Building patterns among these 'chunks' was the next stage in the analysis, a way of identifying emergent themes, or explanations. This procedure was rather like cluster or factor analysis in statistics; 'chunks' were summarised into more meaningful, parsimonious (or simpler) units of analysis, or patterns (Miles and Huberman, 1994) along hierarchical schema. Checking both within and between groups was an essential part of this pattern building, to ensure the themes were typical, and important for further study. While the researcher was guided by the conceptual framework from the literature, there was a degree of flexibility in the assigning chunks into patterns.

An example of the hierarchical approach is illustrated by the example of influences relating to the food (fruit and vegetables) itself. Within the broad chunk of 'Product' was contained 'quality', 'product expectations', 'product appearance', 'preparation difficulties', and 'sensory aspects of product' (shown in Appendix 3). Within 'quality' was included all experiences coded as 'Q' for quality of fruit and vegetables , 'Per' for perceptions, 'Form' for form of produce, and 'W' for waste associated with fruit and vegetables.

4.4.3 Reliability and validity

Validity concerns whether an instrument measures what it is supposed to measure. Applied to the focus group methodology, this may be whether or not the researcher has gained full access to the knowledge and meanings of participants. With group interaction key to the nature of the responses from each individual, it is unlikely that in another mix of group members, exactly the same information would be collected (Carey, 1995). However, this information can be considered as a representation of those participants perception of reality, and it therefore represents construct validity (Robson, 1993).

Focus groups are not usually conducted in settings natural to the participants, raising questions as to accuracy of what the participants say, i.e. the ecological validity of the findings. A solution to this problem is to conduct the groups in settings as natural to the respondents as possible, or where the behaviour may occur (Morgan, 1988). Since all discussions were conducted in the regular meeting place of the group, this problem of ecological validity is overcome.

Reliability means ensuring that the measures used will always give the same conclusions regardless of observer or situation. Within the qualitative framework, reliability is more usefully conceptualised as the extent to which different researchers, on different occasion, would make similar observations (Easterby-Smith et al, 1991). A typical approach to controlling issues of reliability would be to have different researchers analyse the data set. For the present study, the author conducted the main analysis, but helpful comments on the raw data were provided by the supervisory team. As far as reliability is concerned, the use of a topic guide means that it should be possible for another researcher to get a similar set of data given the same group.

Calder (1977) argues that the notion of generalisability related to focus groups is irrelevant, particularly when exploratory. Since the aim is generating the hypotheses, to be validated in a quantitative study, then the validity issue is one of concern not at the qualitative stage, but for the quantitative research, where steps are taken to ensure the constructs generated from the focus groups are validly operationalised in the interview or questionnaire schedule. There is, however, a measure of generalisation of findings common in practice. If after several sessions have been conducted, no new material is emerging, it is fair to cautiously generalise to similar groups (Krueger, 1994; Morgan, 1988). This was the guiding principle with this research study.

4.4.4 Limitations of the qualitative research

The main limitation associated with this part of the study was access to groups. Recruitment for participation was difficult, especially among the higher socio-economic group. More community activities, such as women's groups, seemed to be evident amongst the lower socio-economic areas, which meant easier access to such pre-existing groups.

The geographical consideration was another issue, especially for Bristol. Time and financial restrictions meant the researcher could not conduct as many group discussions as would be desirable in Bristol, and surrounding area[3]. However, it was still a productive exercise, broadening and confirming many of the issues raised in the previous focus groups.

The last major restriction stems from the sample consisting of all women at this stage. Early in the planning of the research it was thought that this would be a study focusing on mothers. However, after the qualitative analysis had taken place, it was felt that men considerably influenced family food choices, and for this reason, their inclusion in the main study would be illuminating. The language used as the basis for developing the questionnaire was generated only by women, yet administered to men and women. In order to reduce any problems associated with this, the questionnaire was extensively piloted, on both men and women (more on this in Section 5.2.3.3), with evaluation questions included, relating to appropriateness of questions, ease of use, etc. No individuals raised any objections to any 'gender bias' in the language or the constructs being measured, which implies little risk to internal validity as a consequence of this limitation. The validity of the focus group method could be argued further by the successful inclusion of males in the later survey, demonstrating the utility of the focus group method.

The remainder of this chapter presents the results of the focus group discussions.

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[3] Two focus groups were conducted in Bristol, 3 in Glasgow and 1 in Edinburgh.

4.5 Results

This analysis was based on the structure emerging from the literature (Figure 2.3), examining marketing influences, internal influences and external influences. Other relevant elements or constructs emerging from the data were incorporated into the model.

The term 'constraining factors' is used to define those factors inhibiting consumption, acting as impediments. An alternative, frequently used, term in health behaviour research is the term 'barrier' to describe a similar construct (e.g. Anderson et al, 1994b; Brug et al, 1995). While recognising that certain factors can have an absolute effect on consumption (e.g. money, availability), the word 'constraining' was used to reflect the possible variations in the strength or importance of a wide range of factors. For example, perceived poor quality of fruit may constrain consumption (i.e. individual does not want to take risk with fruit). However, whether this represents a barrier or not to consumption very much depends on the other factors in place which may have a greater or lesser importance for that individual. For this reason these generic terms (constraining and enabling) were used to assist conceptualisation of the potential interaction of influencing factors.

4.5.1 Marketing influences

Under this category of marketing influences, the main influences relating to the product, price, promotion and distribution, or place, were all considered.

4.5.1.1 Product

There was strong belief overall that the quality of fresh fruit and vegetables available was poor, with only those in the higher socio-economic groups mentioning the better quality available in supermarkets. Due to perceived inadequacies of fresh produce, different forms of produce were deemed acceptable to the participants. However, the acceptability of these alternatives varied by socio-economic group. Amongst the higher socio-economic group, the order, of acceptability, was fresh and then frozen, but almost never canned.

We have a lot of frozen peas and beans. Mainly because I'm not sitting there shelling peas. Otherwise they can be quite expensive fresh, that's why I buy frozen. (High socio-economic group, Bristol)

The opposite was the case amongst the lower socio-economic groups, where canned vegetables were most acceptable, mainly due to the predictable quality of the product. An important issue, for this group, was the risk of waste associated with food. Fresh vegetables, and sometimes frozen, were often seen as too risky.

Like I had carrots in the fridge that I had to throw away cos they just went rotten....while if you have the tin they last for ages. (Low socio-economic group, Glasgow)

Plus some of the frozen stuff you can get have got black marks on them and if that's seen on a plate "I'm no wanting that - that's off". Or "that's bad". (Low socio-economic group, Glasgow)

The limited acceptability of fresh for these groups, as opposed to frozen or canned produce, may be partly explained by the perceived quality of fresh produce, and its storage characteristics. Issues of acceptability are closely linked to price and availability, with these factors (quality, price and availability) being mentioned far more frequently in the lower socio-economic groups than in the higher socio-economic groups.

Related to the quality issue, was the view that the physical appearance, of the fruit or vegetables, frequently had little bearing on its flavour, most often the case when the produce looked good. This led to a situation where fruit and vegetables were purchased but not consumed.

And oranges I think can be quite hit or miss as well, because I will not force myself to eat an orange if it is bitter (High socio-economic group, Glasgow)

Amongst the higher socio-economic groups, there were fairly high expectations with regards to the range of fruit and vegetables that *should* be available. Disappointment consistently characterised the fruit and vegetable consumption experience.

I mean tomatoes are a good example of how fruit and vegetables can vary so much, cos *you've had a tomato and thought that is really a great tomato...and then 90% of the rest of them are totally bland (High socio-economic group, Glasgow)*

It became clear that these high expectations were based on previous positive experiences of fruit and vegetables, although this was only discussed at length among the higher groups. Overall, within the lower socio-economic groups, expectations were not discussed. This may have been because they had little experience with fruit and vegetables, but more likely it was because they had too many bad experiences with fresh produce, influencing the way they learned about the product.

The preparation associated with vegetables was frequently mentioned as a constraint on consumption. The time and difficulties associated with preparing fruit and vegetables affected the types of produce chosen, with the preparation of some vegetables seen as labour intensive,

..... sprouts cutting and taking the leaves, the bad leaves and all the work (Low socio-economic group, Glasgow)

Fresh spinach is such a nuisance to clean. It takes such a long time - lots of animals and things (bugs).....I just give up. (High socio-economic group, Bristol)

perhaps explaining the tendency towards canned produce, for convenience.

With a tin you just open it, and throw it into a pot (Low socio-economic group, Edinburgh).

Across all groups this was frequently mentioned, contributing to the perceived acceptability of canned produce, amongst the lower socio-economic groups, and reliance on frozen amongst the higher socio-economic groups.

4.5.1.2 Price

All groups mentioned the high perceived cost of vegetables and fruit (especially relative to other less healthy foods), as an important factor constraining increased fruit and vegetable intake. Most felt that fruit and vegetables were just too expensive.

> *I think of nutrition sometimes and then I think of the price. I mean it's so hard to do if you've no got the money - I mean, look at the price of fruit. It's an expensive business. (Low socio-economic group, Glasgow)*

> *I find fruit and vegetables, particularly fruit, is very expensive. And it's going up steadier and steadier. Apples - if you can get a decent apple and think what it costs.... it's not often you get good apples. (High socio-economic group, Bristol)*

Repeatedly expressed throughout the discussions was a sense of disbelief at the cost of fruit and vegetables, relative to other comparable foods. A significant constraining factor on increased fruit and vegetable consumption, this apparent disbelief was persistent across all socio-economic groups and areas.

> *Leeks were 90p/lb...I mean for leeks! I think I have stopped buying leeks for a while because they were so expensive (High socio-economic group, Glasgow)*

> *And the prices of them - peppers are ridiculous prices....and I'm not prepared to pay a premium for the so-called organic stuff. (High socio-economic group, Bristol)*

> *When you think it costs 27p or something for a tin of spaghetti. For a pound of sprouts you'd be 60-odd pence or something like that. (Low socio-economic group, Glasgow)*

There was sometimes a sense of guilt attached to such views, particularly where children were involved.

> *And it's a terrible thing to say, but sometimes I grudge it cos it's so dear...last week I went into Malcolm Campbell's in Rutherglen, and I was £7, and it was just a couple of bits of fruit and vegetables....that's a lot of money. When you've not got a lot and you're taking that off....£7... I could get a few dinners out of that. (Low socio-economic group,*

Glasgow)

The interesting aspect of perceptions of price of fruit and vegetables was that there was not much variation across the groups (i.e. between socio-economic groups or by place). However, the difference lay in the perception of the importance of fruit and vegetables in the diet, with those in higher socio-economic groups accepting fruit and vegetables as a key component of a healthy diet. In the main, even when prices were thought to be high, those in the higher socio-economic groups were not constrained by price.

> *I think also if things like fruit and vegetables are more expensive, you're thinking at the back of your mind that it's doing you some good. (High socio-economic group, Bristol)*

4.5.1.3 Promotion

Innovative communication strategies by health authorities, particularly in Scotland, aimed at increasing fruit and vegetable consumption, appeared to be confusing for the participants. Across all groups there was evidence of misinterpretation, or confusion, with regards to healthy eating. Confusion over what these fruits were like, what to do with them and perceived expense, all combined to inhibit consumption of these varieties.

> *I've seen posters - one says 'you know when you've been mango'd' but it doesn't tell you what on earth to do with a mango - so that you can actually eat it! (High socio-economic group, Glasgow)*

The benefits of a healthy diet and increased fruit and vegetable consumption in particular were not clearly understood.

> *I heard somewhere recently that an apple a day wasn't good for children's teeth, actually. Because of the acid in the apple, have you heard that? And in fact that the chocolate was better than other sweets because it didn't stick to their teeth, it wasn't a sticky sweet.....I didn't find this message at all shocking, because that's what I would think would be the case, and I've always given the children chocolate. (High socio-economic group, Glasgow)*

Confusion surrounding benefits of increased fruit and vegetable intake seemed to lead to the perception that with so much conflicting information, it was easier to ignore it all.

I don't think people bother with that. If you eat this, you've got a chance of this. Nobody bothers with that. You do hear it but you hear so much. If you did everything you wouldn't eat anything. (High socio-economic group, Glasgow)

However, a further element to this aspect of confused messages, was which foods were believed to be healthy (or not). For example, frequently mentioned was the view that carbohydrates were bad, with frequent avoidance of such foods in evidence.

Even before I started my diet, I did in the last year or so, I tried to change our diet, I really have. I've tried to cut out more potatoes and things, starchy things and tried to put in more rice and pasta and things like to substitute, instead of potatoes and chips and that. (Low socio-economic group, Edinburgh)

I quite often eat just bread and butter in the evening if I'm in on my own, and I know it's dreadful, cos it's huge great doorsteps of bread... (High socio-economic group, Bristol)

Clearly there was a belief that healthy eating and dieting were synonymous, i.e. to eat healthily means to cut out carbohydrates, an old message advocated in dieting. Although contemporary nutritional science does not promote this view, these old ideas still had credence amongst many interviewed. Another commonly expressed view, related to this, is that eating healthily automatically leads to weight loss. When asked why they ate healthy foods a common response was,

Keeping your weight down - you lose weight (Low socio-economic group, Bristol)

This dieting view may partly explain the perception relating to carbohydrates (traditionally omitted as a dieting measure).

4.5.1.4 Availability

Most fruit and vegetable shopping took place in the supermarket for the higher socio-economic groups, with many describing the good range available, and the general good quality (although this is in contradiction to some of the earlier discussions).

With Safeway, I can generally put most of the vegetables in the fridge and they'll keep for quite a long time, whereas if you buy it from the local one there is a day or two if you're lucky. (High socio-economic group, Glasgow)

However, many of these same participants were keen to buy from markets

Why is it that Scotland doesn't have this tradition of a daily market? We used to go on holiday to Fife and the wee shop there....she (owner) would have local spinach, beetroot, and just whatever... they would always be labelled as such, and it was nice...straight out of the ground, it was lovely (High socio-economic group, Glasgow)

My first choice would be a market, where you could haggle over the price. That's real food then.... (High socio-economic group, Bristol)

or from local shops.

If there was a good fruit shop...just wee local fruit shops and were much cheaper and you could walk home with it... (High socio-economic group, Glasgow)

Generally, dissatisfaction was expressed at the quality available in small shops, with few consumers willing to compensate quality for price, discussed already in Section 4.5.1.1. Shopping outlets were not discussed in as great detail amongst the lower socio-economic groups (perhaps due to their lower consumption), but when it was discussed, small local shops were mentioned, often perceived as selling sub-standard produce.

You go down Allison St. and there's one (fruit and vegetable shop) on every corner....half the stuff's rotten right enough (Low socio-economic group, Glasgow)

The lower socio-economic groups mainly shopped at local shops, but were often not happy. All groups discussed difficulties inherent in shopping in large supermarkets on a regular basis (distance issues); because of these difficulties, many accept that fruit and vegetable intake is reduced.

Vegetables I prefer to buy on a daily basis but our local fruiterer and greengrocers has *closed down and is now a video shop.. so unless you're willing to go to Safeway's every day, it's not so easy.... (High socio-economic group, Glasgow).*

The idea of shopping at local markets, or street stalls was raised, but generally not popular as associated with travel, and hence transport difficulties. Markets were not normally available locally for the participants, thus representing a further constraint on their consumption.

4.5.2 External influences

The external influences on fruit and vegetable consumption were cultural (including symbolism associated with food consumption), meal structures and eating habits (where context of consumption and snacking behaviour are considered) and the influences of the family (in particular satisfying others' preferences).

4.5.2.1 Cultural influences

Frequently discussed was the belief that fruit and vegetables (fruit in particular, but also salads) were difficult to incorporate into UK culture, due to climatic factors. An important constraining influence on fruit consumption (related mainly to the product) is the fact that 'cold' fruit doesn't go with the British (particularly Scottish) climate (generally cold, wet), and hence is not appropriate.

The British weather doesn't lend itself to eating a lot of fruit and vegetables. (High socio-economic group, Bristol)

I don't think the climate here encourages people to eat fruit.... (High socio-economic group, Glasgow)

Closely linked with this is the perception that 'cold' fruit doesn't go with hot drinks, such as tea and coffee.

I will have tea, I'll have gallons of tea and I couldn't have a bit of fruit with it (Low socio-economic group, Edinburgh)

These climatic factors have implications for, and are difficult to separate from, the sensory aspects of foods. It is interesting to observe the extent to which the views expressed are culturally bound; if there was a warmer climate in the UK, then it is, arguably, less likely that people would be drinking the 'gallons of tea' that do not go with the fruit. On the contrary, the norm would likely be consumption of thirst-quenching fruits and salads, with less consumption, perhaps, of hot drinks. This was discussed at length by the high socio-economic group in Bristol, a few of whom had lived, or travelled extensively, in warmer climates.

> *When we were in Italy we used to eat loads of salad. I mean all I'd have at lunchtime and in the evening is these enormous salads with everything in them. All type of lettuce, watercress, etc..I would happily eat melon straight from the fridge all chopped up (High socio-economic group, Bristol)*

Amongst the higher socio-economic groups, the climatic factors were not seen as a great constraint on increased consumption. While being disappointed with fruits and vegetables available, compared to what they may have once been used, they still are conscious of the necessity, to their diet, of these foods, and adapt accordingly (e.g. respondent who has lentils and beans as vegetables). This was a view shared by others. Clearly, motivations (health, family) and abilities (financial and culinary, etc) are different between the groups, a difference mainly observed at a socio-economic level. Another point related to the climatic factor is that this has inevitable consequences for the range of vegetables and fruit available, which may influence the increased acceptability of canned and frozen vegetables in Scotland in particular.

The role of cultural meaning and symbolism, and its influence on food habits, was a recurrent theme, particularly in Scotland. Clearly foods have specific roles or functions, imbued with cultural meaning, which it can be difficult to alter or influence in favour of other foods (such as fruits and vegetables). There seemed to be an almost resigned acceptance of the way the Scottish cook and eat; it was viewed as a 'way of life', and altering it would be outwith the individual's control.

> *We heat them up in hot water, put some salt in and that's it, that's your veg ready, whereas other countries do a lot more to make vegetables much more attractive. (High*

socio-economic group, Glasgow)

Tied to this is the feeling that introducing change will not be accepted,

> *I remember my dad used to say... "I don't want my pudding for my main course - put that away". I think it was pineapple or something she (mother) once tried to give him in a salad. (High socio-economic group, Glasgow)*

with the 'traditional' view that men require more substantial meals surfacing.

> *I think there's this sort of image that the man always has to get a big meal. I mean, everybody does it - the man gets his big meal. (Low socio-economic group, Glasgow)*

This was barely mentioned by the Bristol groups, perhaps more a consequence of the higher socio-economic background of the participants. Many of the individuals in the Lawrence Weston, Bristol group were single mothers; while the absence of a males in the family setting could explain their limited discussion surrounding the needs of men, it should be noted that within the Scottish groups (particularly Toryglen, Glasgow and Sighthill, Edinburgh) the majority of participants were single.

4.5.2.2 Meal structures and food habits

Certain foods were believed to be appropriate only in certain situations, representing a major constraint on increased fruit and vegetable consumption, especially amongst the lower socio-economic groups. It was clear that foods fulfilled specific functions, and were only appropriate in very specific meals.

> *Well actually I only eat carrots if I'm having mince or if I was having a pork chop. If I was having a pork chop I'd have the tinned carrots. If I was making mince I'd buy both I'd have my tinned carrots on the side but I'd have my raw carrots in the mince, cooking. (Low socio-economic group, Glasgow)*

This represents a constraint on consumption, since fruit and vegetables are only consumed in their appropriate context, and quite definitely not at any other time.

> *He'll eat turnip, he likes turnip, but I'll only buy turnip if I'm having haggis....And I wouldn't have it with any thing else. (Low socio-economic group, Glasgow or Low socio-economic group, Edinburgh?)*

It was interesting to note the consumption of certain vegetables only for 'special occasion' meals, e.g. Christmas, St. Andrew's day. This association of vegetables and special occasions, while evident amongst the lower socio-economic groups, was scarcely mentioned within the higher socio-economic groups. Another contextual aspect of consumption was related to where and when in the day fruit and vegetables were consumed.

> *And also I take fruit to work with me, but I don't eat it at the weekend...I don't know why....I think it's because I can take it to work and I can eat it during work, but then at the weekend I'll not want to eat it. (High socio-economic group, Glasgow)*

Perhaps this is explained by the more rigid structure associated with the working day, than with weekends in the home. Issues of discipline are apparent here; discipline in eating habits is easily incorporated into the highly structured working day.

> *I eat a fairly healthy diet, but sometimes at the weekend, I think, oh, it's the weekend,*

treat myself.... buy something sweet, while during the week I'm probably a bit more disciplined. (High socio-economic group, Glasgow)

The weekends are viewed as leisure time, and food consumption patterns that reflect this are acceptable to the individual. If healthy eating is not associated with or compatible with leisure time, then it will not be adopted as such (i.e. weekends). While these patterns were expressed more freely amongst the Scottish higher socio-economic groups, there was evidence of similar 'rules' for consumption of vegetables among the lower socio-economic groups in Scotland.

But I eat a lot of veg. Every night we eat veg, every night. I wouldnae at lunch time - I wouldnae think of making cauliflower or something for my lunch (Low socio-economic group, Edinburgh)

Within the lower socio-economic groups an analogous manifestation of this construct, of appropriateness of certain foods, was in treats given to children. Frequently, participants discussed how fruits and vegetables were not viewed as treats, while other foods were.

I mean it's important to get a balance - give them fruit and vegetables but also they have to have chocolate and crisps and things too (Low socio-economic group, Bristol)

The contextual factors influencing fruit and vegetable consumption go beyond specific meals, extending to time of day (e.g. at lunchtime for those in work), and day of week (some found it easier to eat fruit at weekend, some found it harder). This relates to other structural factors, such as working status, presence of children, other demands on time, and also the very strong sense of the incompatibility of leisure time and healthy eating.

Related to contextual factors is the notion of a proper meal, and the role of meat, particularly in reference to men's needs. A common thread across most of the Scottish groups was the idea that meat is an important and quite necessary component of a meal.

I made a lovely dish on Friday, and it was using up a cauliflower that I had and some potatoes...and we were both really stuffed, and there was loads left, and he said about an hour later "that was really nice, but I missed...". You know, it was just vegetables at the end of the day... (High socio-economic group, Glasgow)

This has implications for increased vegetable consumption in particular, since one possible strategy for increasing vegetable intake is by replacing meat or decreasing meat consumption. Even when the motivation was there, the cultural role of meat in the Scottish diet prevailed. This did not emerge amongst the Bristol groups; on the contrary red meat consumption seemed less important, with an emphasis on fish and chicken, which were perceived as healthier options (this was raised in the higher socio-economic group in Bristol, but not discussed at all in the lower socio-economic group).

A lot of pasta, with home-made fresh sauces and a lot of vegetables, chicken, not much red meat. I eat a lot of fruit (High socio-economic group, Bristol)

Across the Scottish groups there appeared a perception that a 'proper meal' should be hot and filling,

They want something hot, they don't really want a pile of salad in a winter's night when they're tired and they're cold when they come in. (High socio-economic group, Glasgow)

and not salad.

I make a salad and he'll (husband) say what kind of dinners that to come home to? (High socio-economic group, Glasgow).

This partly reflects climatic differences, but perhaps is more closely related to family influences. Traditional values associated with meal structure and women and men's roles in the family were very strong. Notions of masculine and feminine foods emerged. While meat came across as a 'masculine' food (similar to the definitions provided by Fiddes, 1991), 'feminine' foods, such as salads were only successfully introduced when incorporating less healthy options, leading to the perception that a substantial meal was served.

I mean if I make a salad I can take a wee bit of lettuce, some tomato, cucumber and a wee bit of coleslaw and a bit of meat. But I make boiled eggs and I grate cheese and I make chips and their plates are overflowing. They say Salad? and I say well wait till you taste my salad and it does fill them up. (Low socio-economic group, Glasgow - discussing husband's response to her meal)

In Bristol this was not so obviously the case. In the higher socio-economic group, a proper meal was characterised by the use of fresh ingredients and cooking 'from scratch'.

A proper meal is buying fresh ingredients - normally that day - and just preparing something from them with fresh vegetables. (High socio-economic group, Bristol)

Another important aspect of meal structure, which influenced the amounts and types of fruit and vegetables eaten, was the role of snacking in daily dietary habits. A common view was that fruit was not suitable as a snack, since snacks are perceived as something savoury, serving to satisfy hunger.

I say "I'm hungry... have a biscuit" and I think "no, I'm hungry, I want a cheese sandwich"....I always associate being hungry with wanting savoury things, salty not sweet.....I mean I don't think of a snack as something sweet (High socio-economic group, Glasgow)

4.5.2.2 Family influences

Catering for various preferences, within the family, was a strong theme, across all groups except, the high socio-economic group in Bristol. Hence, the scenario where two or more variations of a meal being produced, was common.

I have to cook 3 meals in my house - I just give them what they want. You can't force them. (Low socio-economic group, Bristol)

This constraint was very strong, acting at two levels. It may indirectly constrain consumption of vegetables, because of the perceived difficulty of cooking different sorts or in different ways. Secondly, in the process of satisfying others' needs and wants, the meal preparer's personal tastes (and beliefs relating to family's well-being) are often sacrificed.

My kids determine what I buy for my meals as well. What they like is what I buy and I just take whatever they leave of it (Low socio-economic group, Glasgow)

Set in this context, where already different tastes are catered for, the provider is buying food for herself based on other's preferences, further reducing the likelihood of increasing fruit and vegetable consumption, for her and her family. It does reduce the control by the provider over what is being eaten. If the guiding principle for meal structures was the satisfaction of the tastes of others, then this further constrained increased in fruit and vegetable consumption by limiting the scope for introduction of new foods (and of vegetables in particular). This was very closely connected to perceptions of food wastage and not surprisingly was a greater concern among the lower socio-economic groups.

Related to catering to family tastes and preferences, was the common view (across all groups) that forcing the family to eat certain foods was not a desirable situation, particularly associated with bad experiences when they (the participants) were children.

> *See, mine won't (eat fruit and vegetables) and I will not force them to eat fruit and vegetables...they have to have a choice (Low socio-economic group, Bristol)*

Memories and experiences from childhood appear to have moulded a common view that 'these things take care of themselves'- like them, their children would develop stable eating patterns when they got older (although there was no indication as to whether these were healthy or not).

> *I remember when I was wee...we were made to eat what was on the plate. I've always said well if they (children) don't like it I'll no give them it, and I always like to give them something I know they will eat....cos I was forced into eating when I was wee....I'll eat anything now right enough (Low socio-economic group, Edinburgh)*

Concern was raised about children's eating habits, in relation to fruit and vegetables, with a range of views from despair to a more *laissez faire* approach (i.e. it would resolve itself with time). It seems many felt they had little control over what their children ate at mealtimes. However, there was a common concern about strategies to achieve increased vegetable and fruit consumption. There was general agreement that simply putting food on the plate would not necessarily lead to consumption.

> *And we would have the lettuce and cucumber and tomatoes and I would give the kids the same, but they weren't eating it and it took them 3 months to eat the lettuce, one would eat the cucumber and one would eat the tomato. (Low socio-economic group, Edinburgh)*

I say have an apple to mine and then you can have chocolate.....that way I can get them to eat fruit. Sometimes she even asks for a banana (Low socio-economic group, Bristol)

Further compounding this difficult situation for mothers was the fear that if they forced their children to eat healthier foods, then they would be left with a sense of guilt.

I find that as well...I say if you don't eat that then your having nothing else, but if they don't eat then you're sitting thinking "oh no, I'm starving these wee people". So I just let them have what I know they are going to eat. (High socio-economic group, Glasgow)

This is linked to parent/child power relations. It was not clear from the discussion how these situations arose, but again the sense of inevitability, in terms of children's diets, prevailed.

A view, common to all the groups, was that much of what we eat evolves from habits set by our parents. Thus 'food patterns' are adopted, and passed on from generation to generation, and will carry on as such. This can work in both a positive, or a negative, direction.

I think with the children a lot of its example... I was never a great fruit eater because I think mainly in my family my mother wasn't that interested in fruit ....we knew that she didn't like it, so it didn't appeal to us because we knew that she didn't like it... I think you are brought up with certain habits (High socio-economic group, Glasgow).

To us the evening meal was always the family occasion. Both my parents cook well, it was an occasion where you'd have a bottle of wine, chat about the day... it's a social thing...that has an impact and carries on when you leave home. (High socio-economic group, Bristol)

Recognising that food habits were not particularly healthy, there was a strong feeling that changing these habits was outwith the individual's control.

Aye, she's eating a bit of sweet corn and things like that off me, when I've been eating a salad, but if you put it out for her, she'll no...I've put it out before and she's no eat it. (Low socio-economic group, Edinburgh)

While this was also expressed amongst the lower socio-economic group in Bristol, one individual came up with a compromise solution

What I do is I say on Thursday (cos I have time then) they can have whatever they want. Then the other days they have what I give them - I think that maybe gets them through the week (Low socio-economic group, Bristol).

If change is believed to be outwith one's control, then this will restrict increased fruit and vegetable consumption, representing a barrier to dietary change. An interesting aspect of the control one has over diet, was that it mainly emerged in relation to others' habits (for whom participant felt responsible), but not so strongly felt, or expressed, at a personal level.

4.5.3 Internal influences

The internal influences were categorised into personal resources (such as time and money available, and skills), psychological influences (motivations and attitudes) and physiological consequences (the problems associated with increased consumption levels).

4.5.3.1 Personal resources

More frequently mentioned among the higher socio-economic groups, than the lower socio-economic groups, was the perceived difficulty of organising a routine which incorporated a healthy diet, and in particular fruit and vegetables.

I find to eat healthily I have to really organise myself. Not like fruit but an evening meal, I've got to think ahead, like, what are we going to eat, and if there's nothing to eat you're just throwing together anything. (High socio-economic group, Glasgow)

This was seen to be time consuming and physically difficult, for example gaining access to good quality produce, reflecting the working status of these individuals. Related to this constraint represented by time available, the view expressed among the high socio-economic group in Bristol, was that it was easier to eat fruit and vegetables at the weekend.

Probably at the weekend I probably manage the guidelines, 'cos I'll have freshly squeezed orange juice and a decent lunch with salads and vegetables and a proper meal with plenty of variety in the evening. Just fresh fruit for dessert. (High socio-economic *group, Bristol)*

The amount of money available was also a factor, with a commonly shared view that they would rather do without than pay perceived high prices.

> *In supermarkets they somehow make it look, smell and feel as though it's ripe and it's not - and it doesn't ripen properly as it should. It's a waste of money. I mean I've given up on buying a lot of these things. (High socio-economic group, Bristol)*

Related to the perceived high price discussed in Section 4.5.1.2, it appeared that when money was tight (for example towards the end of the month), eating fresh fruit and vegetables, and eating healthily generally, became a low priority.

> *At the beginning of the month when you've just been paid, and you've got some money you can go in and buy fruit and vegetables and chicken and fish...but then as you get skint you tend to just buy sausages or something cos it's cheap...and they're probably not very good for you. (High socio-economic group, Glasgow)*

Time available to shop for and prepare vegetables, fruit and healthy meals was perceived as limited. This was particularly the perception for vegetables, which are viewed as inherently time-consuming to prepare.

> *Time mainly. I hate cooking and I don't want to spend more time preparing veg. - and then more washing up. I mean I love veg, but I just don't eat them that much (Low socio-economic group, Bristol)*

Further, where there were children involved, time was an even bigger factor. A common feeling was that most mothers wanted the food on the table as quickly as possible.

> *I couldn't encourage that* (trying unusual veg, fruit, foods, etc*), cos I just want to get them out of the kitchen and get the dinner made as soon as possible (High socio-economic group, Glasgow)*

While recognising that including children in the cooking process may assist in increasing their consumption of vegetables, it was viewed as an inherently difficult strategy, especially when there were other young children about.

I'm trying now with the two older ones, they want to help and that's great if I've got the time, but I'm standing there trying to do one thing and I'm standing there watching her with a knife thinking 'oooh, get your fingers out' (High socio-economic group, Glasgow)

This view was evident across all the groups; where there were children in the household, this was frequently mentioned. Only the higher socio-economic groups related this to the demands of work.

There was a common view evident amongst the Scottish groups that their cultural background limited their experience with fruit and vegetables, and this was outwith the individual's control, not subject to change. As previously discussed this related to the feelings of control individual's felt over their family's eating habits. Related to this was a perceived ignorance related to cooking and preparing different fruit and vegetables in unusual and exciting ways. This was not just limited to the more 'exotic' varieties.

I'd never buy tinned carrots either, never. I wouldn't be very sure how to cook fresh carrots though (Low socio-economic group, Glasgow)

Yeah, I think if we have to eat 5 portions a day then you want variety, so we need to know different ways of cooking them. (Low socio-economic group, Bristol)

Perhaps again this goes back to control - individuals feel they have little choice or control in their diet, because they do not know otherwise. The other factor tied up in this is the notion of wastage, a major constraint, particularly on the lower socio-economic groups. If 'experimenting' involves the risk of non-acceptance of a meal, then it will be avoided, constraining efforts to increase fruit and vegetable consumption through both 'new' produce and innovative cooking/ recipes.

But again a lot of things I do make I make from scratch, but it's not a lot, cos my weekly teas are really limited. I tend to buy the same things because I know we'll like them (Low socio-economic group, Edinburgh)

4.5.3.2 Psychological

Different motivations and goals for eating fruit and vegetables emerged from the discussions. While some were driven by a desire to protect their own and their family's health, others were more influenced in their eating habits by the more immediate or hedonic aspects of food. These motivations and goals are discussed in this section, in terms of higher level goals (such as health protection), medium term goals (e.g. appearance related) and more immediate term (such as hedonic satisfaction).

As discussed in sections relating to social and cultural influences, when fruit and vegetables were successfully incorporated in the diet it was often due to beliefs about the benefits of adopting a healthy diet. When the consequences of eating healthily were thought to be beneficial to the individual or their family then other constraining factors had less importance. This is evidenced in the discussion of price and fruit and vegetables. The long term motivations for eating fruit and vegetables appeared to be very important, when other factors were in place (e.g. financial resources to be able to purchase the fruit and vegetables). Those in higher socio-economic groups, who were tending towards or trying to achieve increased fruit and vegetable consumption, perceived fruit and vegetables as a key component of a healthy diet.

> *I do feel its expensive, but I just take the view that that's part of their diet and it just has to be paid for (High socio-economic group, Glasgow)*

There was a difference between the higher and lower socio-economic groups in relation to fruit and vegetables, particularly amongst those with children. While all in the higher socio-economic group accepted the cost, viewing the health benefits to be of greater value, those in the lower socio-economic group, while feeling guilty about not giving family fruit and vegetables, were more likely to do without. On balance within the higher socio-economic groups other factors were more important than price.

It is well established that consumer motivations are often driven by underlying values (Pieters et al, 1995), and in this context, consumption (or provision) of fruit and vegetables is instrumental in helping the individual achieve some goal that is linked to a higher level value, such as 'physical fitness and well-being' (Schiffman and Kanuk, 1997).

Medium term motivations were those goals which satisfied some shorter term motivation, such as self esteem. In this context (of fruit and vegetables and healthy eating), these were mainly appearance-related. This emerged when participants were questioned as to the benefits of increased fruit and vegetable consumption. Consistently, and across all groups, were mentioned *'shiny hair'*, *'skin'* and *'weight loss'*.

It also became clear that while respondents discussed consumption of fruit and vegetables in the context of 'healthy eating', the main underlying goal was weight loss, not improved health. It was frequently assumed they were the same (dieting and healthy eating), and this was the prime motivation for any of the participants who successfully altered their diet in some healthy way.

> *I've got a healthy diet just now as well, but that's 'cos I'm dieting (Low socio-economic group, Glasgow)*

The third level of motivation, driving consumption of fruit and vegetables (and other less healthy foods), related to the hedonic aspects of consumption. Hedonic consumption relates to the experiential aspect of consuming foods, and is concerned with variety and novelty seeking, as well as the emotional aspects of consumption. 'Comfort foods' were often discussed (across all groups) as satisfying sensory and experiential functions, unable to be met by fruit and vegetables.

> *..I comfort eat...so you take the sweetest which is probably the worst...I mean you don't go for an apple when you want to comfort eat do you? You go for ...ice lollies!...the past three nights I've trundled up to the shops cos I've had to have an ice lolly (Low socio-economic group, Edinburgh)*

For such foods, many of the issues that seemed to constrain fruit and vegetable consumption (such as price and availability) were no longer as important. Availability may be seen to be a barrier to fruit and vegetable consumption, but this individual highlights the effort that will be made for attractive products or foods that satisfy certain hedonic motivations. Clearly motivational factors are an issue, and values driving such behaviour may be termed 'pleasure' oriented.

The sensory satisfaction derived from fruit and vegetables was often not great; they were frequently described as boring and tasteless, unable to satisfy the hedonic, or experiential aspects of consumption. Added to this, an inherent dislike for vegetables and fruit was frequently discussed.

> *I don't like cabbage or anything like that. It's disgusting. See the smell of it - it's just tasteless. I prefer carrots and things like that. I like baby carrots. I like them. (Low socio-economic group, Glasgow)*

> *I just don't like veg. I don't know why - my mum still tries to slip some parsnip in with my potatoes or whatever, but I just hate them. (Low socio-economic group, Bristol)*

When vegetables preferences were discussed, the sweeter varieties were favoured.

> *I dinnae have a salad cos I don't like tomatoes, so what's the point if I don't like tomatoes? So I have cheese, sweet corn, coleslaw (Low socio-economic group, Edinburgh)*

This view was less prevalent amongst the higher socio-economic groups, who frequently expressed a genuine liking for fruit and vegetables.

> *I enjoy vegetables, I eat vegetables quite a lot (High socio-economic group, Glasgow)*

> *We eat lots of fruit and I absolutely love vegetables I could have a plate of vegetables for my dinner every night I just love them...but they can't stand them, even my husband. He'll tolerate them, cos I make them (High socio-economic group, Glasgow)*

> *I find that the children like some vegetables, they like some ways I do potatoes and they like sweet corn and two of them will eat carrots, so, I have to juggle the pots when I'm making the vegetables, but I give them what they like. (High socio-economic group, Glasgow)*

An interesting point about both these views, is that the second one illustrates how the tastes of the mother or provider does influence others in the meal situation, while the last one shows that in the interest of health, the provider will go out of her way to cater for these varying tastes. It may be the experiences of those in the higher socio-economic groups that so strongly influences their motivations to consume, both in terms of their liking for fruit and vegetables and also in terms of longer term motivations. The appearance related motivations were less frequently mentioned by higher socio-economic groups.

The second main psychological influences were attitudes and beliefs in relation to health, which varied across the groups. A moderate diet was advocated by many, although there was considerable variation in what this actually meant on a day-to-day basis, with quite confused attitudes and beliefs in relation to health and diet emerging. In this context sweets and chocolate were seen as an acceptable part of everyday eating.

> *Then again everything can be healthy depending on how you eat it, everything in moderation, everything's healthy. I mean you do need a certain amount of sugar, you do need a certain amount of sweets. I mean as long as you eat in moderation (Low socio-economic group, Edinburgh)*

> *I think you should have a bit of everything.....you shouldn't actually feel guilty about eating a bar of chocolate. There is a time and place for everything. (High socio-economic group, Bristol)*

This in itself can be a constraint on increasing fruit and vegetable consumption since individuals are perhaps not entirely convinced of the roles/contribution of different foods, in particular fruit and vegetables.

Pressures from outside (such as family and friends) was another constraint on consumption, with satisfying the expectations of others of paramount importance for the participants. This resulted in a normative pressure to consume other foods.

> *And with children you always have to have a bag of sweets or something in the house for friends coming...because other children expect to come and to be given a little biscuit or something when they come to visit. (High socio-economic group, Glasgow)*

This was particularly so for children. As one comment illustrates, the pressure to give children what is socially appropriate constrains consumption of fruit, as a substitute to other treats.

And if your children are about with other children, and you're trying to give him a banana or something like that and they (other children) are all running about with sweets, they're not wanting it. They want something else - especially the same as those all around them. (Low socio-economic group, Glasgow)

4.5.3.3 Physiological consequences

Difficulties associated with increasing the volume of fruit and vegetables consumed (to five portions per day) were widely discussed in Scotland. There was a common perception that eating fruit and vegetables requires some sort of stamina/adherence,

I think you would just sicken the kids with it, if you had to do that (eat 5 portions per day)...Chris has to be in the mood for fruit (Low socio-economic group, Edinburgh)

and that eating fruit and vegetables is a chore

I don't think I could eat that much in a day. I mean 5 portions - if you don't have much for breakfast and you don't have a big lunch, then maybe have 2 or 3 vegetables at the most with your dinner - I mean what are you supposed to be doing? eating apples all day in between? (High socio-economic group, Glasgow)

In Bristol, while increasing consumption was also perceived as difficult,

I don't (eat 5 portions of fruit and vegetables/day). I know I should, and I do like veg, but other things are nicer or easier - like chips (Low socio-economic group, Bristol)

respondents were more likely to propose strategies for incorporation of fruit and vegetables into their normal daily diet.

Yes I think it's easy - have some salad at lunch, a couple of nice veggies with your dinner and a couple of piece of fruit throughout the day - that's not that hard. (Low socio-economic group, Bristol)

I like bananas and what I do is buy oranges, I don't enjoy eating them but I squeeze the juice and drink that, but I don't actually like peeling an orange and eating it...I like the *summer fruits - strawberries, raspberries, peaches. I'm not really a great apple eater, but what I try to do in the winter is buy lots of apples and make them into pies and things (High socio-economic group, Bristol)*

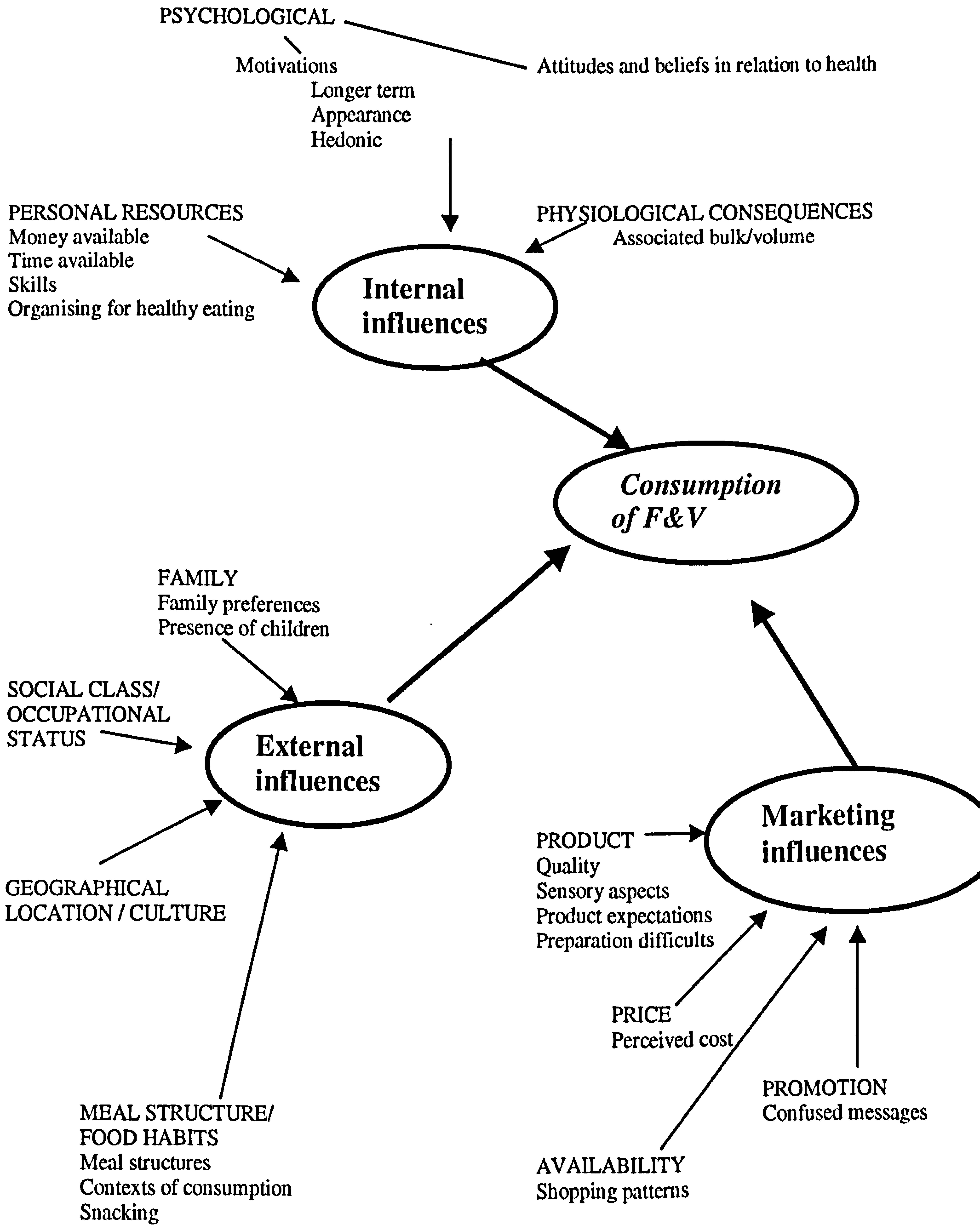
Further, participants in Scotland made sense of such claims relating to volume by looking externally for support (media, etc.). This following view was expressed in most of the Scottish groups.

'Cos they did a documentary once where a politician bought the family's food and they had to eat for a week, and all the kids..said it was disgusting, baked potato after baked potato and grilled fish and that. I mean it's nice if you have it now and again, but having to have it for the whole week, it's disgusting (Low socio-economic group, Glasgow)

4.6 Discussion of results

The literature suggested that there were certain factors which influenced fruit and vegetable consumption, which could be classified as relating to marketing influences, external and internal influences. A summary of these influences can be seen in Figure 4.1, which is developed from Figure 2.3.

Figure 4.1: Fruit and Vegetable Consumption (qualitative)



As analysis progressed, it became clear that this framework for analysis was useful for classifying the diversity of experience with fruit and vegetables, but was not really adequate to fully explore the underlying reasons for fruit and vegetable consumption. For example, the product form (canned, fresh or frozen) was initially discussed at length within the product section. However, as reasons emerged for differences in acceptability of the different forms, it became clear that these were not due to simply personal preference. Availability, time and money available (not product characteristics) all influence the decision as to which is acceptable. This highlights the complex nature of the behaviour, and the difficulty with attempts to unpack the main constraints (impediments) to consumption.

However, the objectives of this stage were to reveal the range of influences, and gain some insight into their relative importance This section will bring together the main findings from the qualitative stage and relate these to findings from other studies into fruit and vegetable research, in order to get some sense of the relative importance of the factors.

Of the marketing influences on consumption of fruit and vegetables, those relating to the product appeared to be the most important. This fits with the food choice models described by Shepherd (1989), where the food itself is one of the key elements influencing the consumption behaviour. In particular perceptions of fruit and vegetable quality and appearance were very relevant. Foster and Macrae (1992) discuss consumer's perception of quality in foods generally, describing the importance of appearance as an indicator of quality. Clearly this is an important factor influencing consumption of fruit and vegetables.

Price was the other main marketing influence, with both fruit and vegetables viewed as expensive. While this was considered to be the case across all the groups, it was observed that the weight attached to this varied in light of beliefs and motivations in relation to longer term health, and the overall health of the family. Perceived cost was mentioned in the study by Brug et al. (1995), but did not appear as strong an influence as in this study. Findings from Brug et al (1995) emphasised seasonal variations in price, rather different from findings from current research. There may be cultural differences in pricing of fruit and vegetables, explaining this shift in importance. Alternatively the respondents for this study were drawn largely from lower socio-economic groups, perhaps explaining their greater price-consciousness. However, it must be remembered that price was an issue across all the groups (both higher and lower socio-economic groups). This suggests the cultural differences are better at explaining the differing importance of price. Marshall et al. (1995) too discussed the financial constraints on consumption, although they did suggest it was not a great concern for higher socio-economic groups.

At a promotional level, it seemed clear that people were confused about healthy eating messages. Keane and Willetts (1994) found a similar confusion as to what constitutes healthy or unhealthy eating. They too found participants preferred to ignore messages, with a common perception that there was too much conflicting information. As a barrier to healthy eating this is perhaps easier to envisage in terms of all food groups; however, within the fruit and vegetable group there are examples where this might constrain fruit and vegetable consumption, e.g. bananas, potatoes and avocados. Linked to this is the notion of healthy eating being synonymous with dieting, a theme which also emerged from the Keane and Willetts (1994) study. Like the health belief expressed in this study that 'everything in moderation' constituted a healthy diet, they discussed balance being key to an understanding of healthy eating.

Shopping at supermarkets increased choice of fruit and vegetables, and thus facilitated consumption of fruit and vegetables. However, this type of retail outlet was more accessible to the higher socio-economic groups. Hence, it seemed that choice of retail outlet was closely linked to socio-economic status, which influenced fruit and vegetable consumption. Marshall et al. (1995) described how individuals fruit and vegetable purchasing patterns were heavily influenced by their shopping patterns generally. Most food shopping took place in supermarkets, with visits to supermarkets occurring on a weekly or fortnightly basis. This meant a reliance on local fruit and vegetable shops or frozen produce; otherwise consumption was constrained. Most participants in that study believed supermarkets to have a wide range of good quality produce, but it was suggested that local fruit and vegetable shops had fresher produce. Seasonality was an influence on fruit and vegetable purchasing patterns. Financial pressures were also an issue amongst the lower socio-economic groups, who traded the convenience aspects of shopping in supermarkets, for the perceived higher cost of fruit and vegetables. Brug et al. (1995) reported availability as a constraint on consumption, but in terms of living close to a fruit and vegetable market, and as a consequence of seasonal variation in availability. This may reflect cultural differences in the supply of fruit and vegetables in the Netherlands compared to the UK, and Scotland in particular. Leather (1995) echoes this in her paper on fruit and vegetable consumption, recalling the food markets in the Netherlands, where the range of fruit and vegetables available (in terms of variety and quality) is better, and the prices tend to be lower.

Cultural influences on fruit and vegetable consumption seemed to be great, particularly acting to influence feelings of control with regards diet. In particular this was made in the context of family role influencing consumption. The family as an influence on food choice has been well-documented (Marshall et al, 1995; Pill and Parry, 1989; Kerr and Charles, 1986). It was a particularly strong finding here, perhaps due to the number of participants with children, for whom many of the concerns raised are very current. There was much discussion of the role of habit in influencing eating patterns, with a very strong sense of inevitability about eating inherited from parents. Brug et al. (1995) also found habit important in influencing fruit and vegetable consumption, discussing this in terms of 'modelling' from Bandura's work on social learning theory. As found in the current study, Brug et al reported respondents believing habits set by parents and family were difficult to alter, and outwith their control.

Another important cultural influence was that of current meal structures, which were perceived as constraining changes within the diet (such as increased fruit and vegetable consumption). Similar to this finding was that of Kilcast et al (1996), where certain vegetables were only appropriate with certain foods. Anderson et al (1994a) also found this to be the case.

The current study suggested that snacking behaviour was another influence, impeding fruit and vegetable consumption, since snacks were often perceived as savoury and filling. The increase in snacking behaviour, characteristic of 1990s living, implies other foods (savoury) will be consumed in preference to fruit, although this does represent an opportunity for increased vegetable consumption. Interestingly the findings reported here (of preference for savoury snacks) contradict those of other studies where fruit was seen as a suitable snack food (Marshall et al, 1995).

The final category of influence related to internal influences, covering personal resources and psychological influences. Preparation difficulties associated with fruit and vegetable consumption were discussed as an important influence, as were money and time available, and lack of skills (particularly in Scotland, clearly linked to cultural influences). While Kilcast et al (1996) and Marshall et al (1995) found similar findings in relation to preparation skills, Marshall et al (1994) discussed a trade-off made by consumers. Similarly, participants in this study appeared to weigh up the benefits of consumption (long term health) to the costs (preparation difficulties), mainly the case among those consumers in the higher socio-economic groups.

The psychological influences discussed were mainly those relating to motivations, such as longer term health. This was mainly discussed amongst higher consumers and was the main influence for them. Other important influences were satisfaction of hedonic motivations, which seemed to be mentioned most frequently amongst those with lower consumption. Brug et al (1995) found health consequences of eating fruit and vegetables to be very important in influencing fruit and vegetable consumption, with frequent and knowledgeable comments made. This level of knowledge about the role of fruit and vegetables for health was not illustrated to the same extent in this study, perhaps reflecting cultural differences. In discussing the perceived health consequences associated with fruit and vegetable consumption, Brug et al (1995) also found weight loss frequently mentioned as a motivation to eat fruit and vegetables. In studies looking at food and fruit and vegetable choice, acceptability is often influenced by enjoyment, satisfaction and taste (Kilcast, 1996; Marshall et al, 1995; Brug et al, 1995; Goode et al, 1996; Ross, 1995; Baranowski et al, 1993). While these are similar to the construct 'hedonic motivation' of this study, the hedonic term goes further as it embodies the experiential aspects of consumption in a wider sense. By considering the experiential aspects of others foods, in relation to fruit and vegetables, the apparent unsuitability of fruit and vegetables, for certain contexts, becomes clearer. Of the motivational influences, the most important constraining consumption appeared to be related to 'hedonic', while the higher level goals of 'long term health' facilitated fruit and vegetable consumption.

4.7 Some reflections and criticisms

4.7.1 Information gathered

Factors enabling fruit and vegetable consumption were perhaps not as numerous as those constraining consumption. This could be a consequence of the type of questions asked, as opposed to the true situation. However, the questioning approach used first established whether consumption or not occurred, and then what influenced this. Since most of the participants in the groups had limited consumption, then their views and perspectives were more likely to reflect this (i.e. constraints). A limitation of this stage could relate to the choice of Bristol as a proxy indicator of an area of high consumption. While it is situated within the Southwest (with the highest consumption of fruit and vegetables in the UK), it is not a certainty that the groups selected would also have high consumption. This could have been rectified by a more formal approach to recruitment, with a screening questionnaire used to measure extent of consumption, or more discussions conducted in Bristol.

4.7.2 Participants

All discussions were conducted with women. The first reason for this was that the original intention of the researcher was to conduct a women only study. The other reason was that as women are most often responsible for meal planning (Kerr and Charles, 1986), it was thought they would be a valuable source of information about the influences on consumption. Thirdly, two variables were used for selecting groups (socio-economic status, and area); the use of men would have meant conducting 3-6 more groups, not practical within the scope of this project.

4.8 Conclusions

The qualitative research built on the model developed in the literature review (as shown in Figure 2.3.). Comparing Figures 2.3. and 4.1 there are many similarities in the basic elements, with the key categories of marketing, external and internal influences remaining in place. However, the ordering of some of the elements has been changed (e.g. Psychological Influences in Figure 4.1. was previously Attitudes, Beliefs and Motivations in Figure 2.3). No information was lost in this revision; the aim was to improve clarity while keeping the model as simple as possible.

In summary the focus groups showed:

1. Of the marketing influences, the overall product quality (and hence perceived acceptability) is a very important influence on consumption, closely related to the price consumers were willing to pay. Consumers appeared to engage in a cost / benefit analysis; for those in the higher socio-economic groups, the value of increased consumption of fruit and vegetable (in health terms) appeared to outweigh the cost.

2. The main external influences on fruit and vegetable consumption related to the influence of the family, in particular the satisfaction of other's tastes and preferences. Cultural norms and eating habits also served to constrain consumption, with greater evidence of this constraining consumption in the Scottish groups than for those in Bristol.

3. Important individual influences on fruit and vegetable consumption were mainly in terms of motivations, attitudes and beliefs. In particular there were considerable differences in the motivations of those who consumed fruit and vegetables, and those who did not. Hedonic motivations were very important for those who did not eat fruit and vegetables, with texture, taste and bad memories being suggested as reasons against consumption. For those who did eat fruit and vegetables, health benefits were mentioned more frequently than enjoyment (or hedonics) as a factor influencing consumption.

While not claiming to provide a definitive model of fruit and vegetable consumption, Figure 4.1 provides greater insight into the interrelationships of the influencing factors than that provided by the literature review and existing models of food choice alone.

Chapter 5 describes how these results were used to develop the questionnaire for use in the survey, and presents exploratory findings from this survey.

Chapter 5 Fruit and vegetable survey

5.1 The purpose of the survey

The principal objective of this stage of the research was to develop a model of fruit and vegetable consumption. To achieve this, the following sub-objectives were set:

1. To establish the most salient variables influencing fruit and vegetable consumption
2. To identify the extent to which each of these variables influenced consumption of fruit and vegetables
3. To compare the relative importance of the factors influencing fruit and vegetable consumption

By meeting these objectives, the simplest representation, or model, of fruit and vegetable consumption will be developed. The philosophical underpinnings of the modelling approaches, and the associated processes, were discussed in Section 3.7.

This chapter begins by describing the survey procedure undertaken. The data set is then described, forming the basis for the models of fruit and vegetable consumption developed and presented in Chapters 6 and 7.

5.2 Survey methodology

5.2.1 The survey instrument

Oppenheim (1992) discussed the importance of measurement of each type of variable (independent, dependent and control) for effective design, drawing particular attention to measurement of the dependent variable. In the present thesis, measurement of these variables began with first defining them, and then developing these into operational terms for the questionnaire. This process of questionnaire development was closely linked with the initial aims and purpose of the research.

A review of the literature (Chapter 2) followed by a series of focus group discussions (Chapter 4) provided the basis for the conceptualisation of the factors influencing fruit and vegetable consumption, and the relationship between them. These were developed into a framework for comparison of the factors both enabling and constraining fruit and vegetable consumption, Figure 4.1. The variables influencing fruit and vegetable consumption, illustrated in Figure 4.1, formed the basis of the questionnaire. However, the final structure of the questionnaire did not exactly mirror the categories found in Figure 4.1; this is because the constructs were re-organised to provide sections which were logical and meaningful to participants, facilitating easy completion.

There were five main sections to the questionnaire:

Section A: Shopping and use of fruit and vegetables

Section B: Food choice

Section C: Food consumption

Section D: General food habits

Section E: Personal details

and a discussion of the items included in each follows.

5.2.1.1 Shopping and use of fruit and vegetables (Section A)

The aim of the first section was to provide information about the marketing of fruit and vegetables, from the consumer's perspective. Specifically, information was sought about the product (perceived quality, overall acceptability, preparation and use of fruit and vegetables) and distribution (shopping patterns in terms of who shopped, where, mode of transport, variety available). The questions were all closed, with categories provided for the various options.

Meal structure and food habits were also postulated to be important factors influencing fruit and vegetable consumption. The final questions in this section were included in an attempt to assess the likelihood of consumption of fruit and vegetables at different meal points throughout the day. Responses to these questions were on a 7 point Likert scale, to provide an indication of the level of agreement for each question.

5.2.1.2 Food choice (Section B)

The statements included in Section B attempted to provide some indication of the relative importance of the main variables influencing food choice in general, and fruit and vegetable choice specifically.

In order to establish the relative importance of each of the variables influencing fruit and vegetable consumption, this section first dealt with the influences on (1) food choice, (2) fruit choice and (3) vegetable choice. General food questions were included, since it was thought this might reveal some further insight into fruit and vegetable choice.

The variables included mainly reflected the internal influences on fruit and vegetable choice as informed by the literature review and focus groups. In particular, the questions aimed to establish motivations and beliefs with regard to fruit and vegetable choice. Motivations associated with fruit and vegetable consumption were conceptualised in terms of goal structures. Specific items were included to measure hedonic goals, appearance related goals and long term goals, as shown in Figure 4.1.

Specifically, the items included in these sections measured: beliefs about the acceptability of the food/product (importance of appearance, taste, convenience), beliefs about family preferences, personal health beliefs, personal resources (e.g. ability to organise for healthy eating), appearance related beliefs and motivations, hedonic motivation and product convenience. This set of measures was repeated for each of food, fruit and vegetables.

Since the Theory of Planned Behaviour appeared to offer some insights into explaining fruit and vegetable consumption, the last sub-sections (questions 4 and 5) included some measures relating to the perceived control, subjective norm and behavioural intention constructs of this theory. Perceived control was not measured explicitly, but was manifest in the range of 7 statements in these sections, since these measured ability and beliefs in relation to fruit and vegetables. An example of ability in relation to fruit was 'fruit takes a long time to shop for', and an example of beliefs was 'fruit makes a good snack'. Since perceived control was not measured directly by the conventional approach, these items are referred to throughout as 'general beliefs about fruit / vegetables'. Subjective norm and behavioural intention to consume more fruit and vegetables were explicitly measured.

Throughout the questionnaire, 7 point Likert scales were used, with values ranging from 1 (strongly disagree) to 7 (strongly agree). This scaling approach is in accordance with standard practice in marketing research, and in most studies measuring such constructs (Oppenheim, 1992; Chisnall, 1986). The use of 7 points scaling meant that the data could be treated as interval data, as long as it was normally distributed (Diamontopoulos & Schlegelmilch, 1997). Bias might have been introduced to the questionnaires by two mechanisms: the wording of the questions and the order of questions. To overcome bias associated with the wording of question there was a balance of negative and positive items included in the questionnaire. The order of the questions may have introduced bias through a framing effect, since the questions were not rotated for different respondents. Such bias could have potentially affected responses in relation to vegetable consumption. The descriptive analysis of the data showed that respondents were responding differently for fruit compared to vegetables, suggesting that bias was not a major problem.

5.2.1.3 *Food consumption (Section C)*

This section aimed to provide a measure of fruit and vegetable consumption, and some information about the context of consumption. An indication of fruit and vegetable consumption behaviour was required which allowed quantification of the relationship between consumption and its influencing factors. Nutritional assessments can be either prospective (weighed food inventory or estimated food inventory) or retrospective (such as 24-hour recall, diet history, food frequency questionnaire and diet inventory) (Anderson, 1995).

In choosing a method, consideration should be given to the degree of accuracy desired, the nature of the nutrients or foods of interest, whether it is current or past behaviour which is of interest and how habitual the diet is (Anderson, 1995). Cost and time involved are clearly important issues; greater precision in measurement of intake inevitably leads to high involvement from the participants and hence greater overall cost (Nelson, 1991).

An overall indication of fruit and vegetable intake was of importance to this study, in contrast to precise nutrient values or records of the actual varieties of fruit and vegetables consumed. Another important criterion was that an approach should be chosen which was easily incorporated into the questionnaire (i.e. self-administered), and also accessible to participants from a range of educational backgrounds. A retrospective approach was considered to be suitable, as it is quick, cheap, makes relatively little demands on the participant and requires low numeracy and literacy skills (Nelson, 1991). Validation of measured intake is especially important when retrospective measures are taken. Internal validity can be achieved by requesting the same information in different ways, while external validity can be established through the use of some objective marker such as a weighed record.

A food frequency questionnaire was designed to assess fruit and vegetable consumption. This extensive questionnaire, which is shown in Section C of the pilot questionnaire (Appendix 5) included global measures of fruit and vegetable intake, to test internal validity (external validity through weighed intake was not desirable due to expense and intrusiveness). The pilot of the questionnaire highlighted certain problems with this tool, in particular relating to the validity of the measure of intake (discussed below in Section 5.2.3).

For this reason, a retrospective diet inventory, the most basic form of dietary measurement (Anderson 1995), was introduced. A dietary inventory seeks information on the frequency of consumption of selected dietary items (e.g. fruit and vegetables) over a specified period of time (e.g. a week). This method only provides limited information on dietary intake, but is suggested by Anderson (1995) as suitable for providing a broad overview of dietary patterns. She suggests it is useful for classifying broad categories, such as 'healthy' and 'unhealthy'; in this study this would be in terms of 'low' and 'high' fruit and vegetable consumption.

Thus, fruit and vegetable consumption was measured by asking respondents to indicate how often they had eaten fruit and vegetables within the last seven days. Further, respondents were asked to indicate how often they had eaten vegetables and fruit in various forms (e.g. as a salad, as a soup, etc.) in the last seven days. Thus frequency, quantity and context of consumption were established. Some information was collected with regards to general eating habits (frequency of meal consumption, types of meals consumed, etc.), based on Cox (1987).

While consumption data were measured in continuous form, and were left as such for parametric statistical analysis, there was little indication of the validity of the consumption data. A decision was made to use this data cautiously, providing an overview of level of consumption, as discussed above. Consumption of fruit and vegetables (dependent variable) was therefore recoded into 2 categories: low, which was less than 7 times per week, and medium-high, which was 7 or more times per week. This had implications for statistical analysis available, but it was believed that loss of statistical power (through limited use of parametric statistical techniques) was preferable to over-emphasising the quality of the dependent variable, fruit and vegetable consumption.

5.2.1.4 Food habits (Section D)

Section D included eight questions measuring aspects of general eating patterns and food habits. This section was included as it was thought this may help in explaining variations in fruit and vegetable consumption.

The first question established whether the respondent was vegetarian or not, followed by two questions about the number of meals eaten on a daily basis. The next question asked about meals outside the home, followed by the extent to which take-away meals were consumed. Snacking behaviour was then explored, with the final questions of this section asking about regularity of eating habits, and perceived healthiness of respondent's current diet.

5.2.1.5 Personal details (Section E)

Certain socio-demographic variables were thought to be important in influencing fruit and vegetable consumption (from the literature review and focus groups), in particular geographical location, social class, sex, smoker status and the presence of children. Other socio-demographic questions were included, to obtain further information on educational levels, housing type and father's occupation, which were hoped to provide some extra information related to social, cultural and historical circumstances. Areas of high and low fruit and vegetable consumption were of particular interest, and how these were selected is discussed in Section 5.2.2.

5.2.2 Sampling frame

Geographical location and socio-economic status had both been identified as variables of importance in influencing fruit and vegetable consumption; thus an approach that included contrasting socio-economic groups in different locations was desirable.

Since Scotland has low consumption of fruit and vegetables, and the Southwest is the region of highest fruit and vegetable consumption in the UK (MAFF, 1994), comparison of a city in Scotland and in the Southwest region was desirable. The main city in the Southwest is Bristol, but it was unclear whether Glasgow or Edinburgh should be chosen as the Scottish site, for comparison. Areas of study within each city were required to represent areas of moderate advantage and moderate disadvantage, thus allowing for socio-economic status comparisons[1].

A useful tool for such a comparison is to use the Carstairs or DEPCAT scores system (McLoone, 1991). Such scores are derived by combining variables taken from small area Census data, and they reflect material resources providing access to goods and services (Carstairs and Morris, 1991)[2]. However, these are only available for Scottish areas, making their use in this study incomplete and inappropriate. In Scotland the postcode sector is the equivalent to the ward in England and Wales (OPCS, 1991). Thus, to select wards and postcodes for study within these areas, a scale of material deprivation/advantage was devised from the 1991 Census (using the approach described by Carstairs, 1994).

To construct this scale of 'relative deprivation/advantage', variables from the 1991 Census CD-ROM were downloaded onto SPSS and subjected to a principal component analysis (PCA)[3]. Variables were chosen which in combination would describe 'relative deprivation/advantage', including occupational status and ownership of home and car.

The variables included were:

1. household with no cars
2. lone parents
3. economically inactive - retired
4. males unemployed
5. males economically inactive
6. females economically inactive
7. owned or buying houses
8. professional males
9. professional females
10. managerial males
11. managerial females
12. non-manual males
13. non-manual females
14. skilled manual males
15. skilled manual females

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[1] Choosing areas of moderate advantage / disadvantage meant avoiding areas of extreme deprivation or advantage at either end of the social scale.

[2] These were used in the sampling for Stage 1 of the research, but only in Scotland - the Bristol areas for that part of the research was chosen based on the contact the author could make, and hence the views of individuals at the City Council. While this was acceptable for the exploratory stage, a more rigorous approach was required for sampling for the quantitative stage of the research.

[3] Principal components analysis is a form of factor analysis and is discussed in more detail in section 5.4.3.1

These principal components, emerging from this analysis, are shown in Table 5.1.

Table 5.1 Principal component analysis of socio-demographic variables from the Census 1991.

Principal component (PC) no./ description of variable loading on PC	Factor loading	% variance.
PC1		48%
household with no car	-0.55	
owned or buying house	0.65	
PC2		18%
household with no car	0.745	
females economically inactive	0.303	
owned or buying houses	0.374	
PC3		15%
professional males	0.627	
professional females	0.579	
PC4		7%
females economically inactive	0.602	
owned or buying houses	-0.488	
PC5		6%
males economically inactive	0.498	
professional females	-0.427	

The principal component accounting for the greatest amount of variance among the groups (48%), was PC1 which related to ownership of cars and house. Glasgow, Edinburgh and Bristol were all included in an analysis of the OPCS data, to uncover the postcode areas or wards, within the cities, which were most similar. The wards for each of these areas were scored by this factor, in order to establish how the postcodes /wards related to each other in terms of this factor. This scale is shown in Appendix 6. The areas falling at the quartile points on this scale were selected as the areas of study for the research, thus avoiding consideration of areas of extreme poverty or wealth, which as mentioned earlier, could unduly skew the research towards financial position solely (or mainly) influencing fruit and vegetable consumption[4]. The areas at the lower point were G14.0, Glasgow and Lawrence Hill, Bristol, and at the upper point G44.5, Glasgow and Easton, Bristol[5]. No Edinburgh areas were included as these postcodes did not lie at the points of interest (i.e. the quartile points). The Electoral Registers for each of these areas was obtained and used as the sampling frame for the study.

5.2.3 Pilot work

The questionnaire was piloted to assess the appropriateness of the sampling procedure, the suitability of the administration of the questionnaire, the method of approach and the instrument itself. A copy of the pilot questionnaire is in Appendix 5.

The pilot work was conducted in Glasgow in July 1995, over a two week period. Areas were chosen which would not be included in the main study, but were similar to the sample in socio-economic terms. Drumchapel and Hyndland were both selected, and electoral registers for both obtained. Letters were sent to 20 individuals in each area, followed by a visit by the author. The questionnaire was deposited and a suitable collection time arranged.

This approach worked fairly well, as shown in Table 5.2.

Table 5.2 *Participation in pilot study.*

	Drumchapel (socially deprived)	*Hyndland (socially advantaged)*
a. Completion	12	4
b. Refusal to participate	2	5
c. Not at home	2	6
d. Other non-participation	3	1
e. Moved on/derelict building, etc.	2	4
f. N	21	20
g. Response rate (as a % of total [f.])	57.1%	20%
h. Response rate (as a % of achievable base [f. - e.])	63.1%	25%

Overall, the response rate was considerably higher in Drumchapel than in Hyndland. The greater participation by Drumchapel residents could perhaps be explained by a number of issues. The Drumchapel residents may have felt obliged to participate (official letter, approach taken), or participated due to the novelty value and the interest in them shown by the researcher.

In Hyndland problems were encountered in terms of access, with many of the sample not at home at any of the times when the interviewer called. This may have been seasonal effects (summer month) and also due to the greater proportion of sample in employment, than in the

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[4] It was also believed desirable, since the researcher would then avoid collecting data alone in areas of extreme poverty.
[5] Glasgow was selected as an area of very low fruit and vegetable consumption and Bristol as the main city within the area of highest fruit and vegetable consumption in the UK (MAFF, 1994).

Drumchapel. Hyndland is also a university area, and it could have been that there was a number of people working at the university in this area who were not about during the summer. Visits were made in the evening as well as during the day to counter this, but a response rate of 25% was all that was achieved.

The completed questionnaires were input onto SPSS to give an indication of the nature of the patterns of response. 'Eyeballing' the data showed participants to be discriminating within each question. It had been anticipated that this might be a problem, particularly in deprived areas (DeVaus, 1996; Chisnall, 1986), but this was not found to be the case. Thus, the design of the 'attitudinal' type questions was not radically altered, although there were a few minor changes in the wording of some of the items.

As mentioned in Section 5.2.2, more serious problems were evident within section C of the questionnaire, the food frequency questionnaire (FFQ) used to measure fruit and vegetable consumption (Section C, Appendix 5). The first two questions provided global measures of fruit and vegetable intake, and the third question elicited detailed information about fruit and vegetable intake, specifically measuring frequencies of consumption for individual varieties of fruit and vegetables. The first two questions, which provided global measures of fruit and vegetable consumption, were included as validation of the FFQ, and fruit and vegetable intake was measured in detail in question three. Analysis of the pilot results, suggested the FFQ instrument was not measuring fruit and vegetable consumption adequately. Overall, the answers to the first two questions bore little resemblance to the answers to the third questions. Attempts at validating these recorded levels of consumption, appeared to fail. Reasons for this are unclear, but perhaps the problem with question three, was that there was an implicit assumption that individuals could remember how they *substitute* one fruit (or vegetable) for another. It also assumed participants could assign quantities to individual items of fruit and vegetables. Lastly, the reliability of the measure was questionable, since there was an assumption that participants could define a portion of fruit and vegetables, which did not appear to be the case.

In redesigning the consumption section of the questionnaire, the researcher returned to the purpose of this section of the questionnaire. A measure of fruit and vegetable consumption behaviour was necessary as a dependent variable, upon which influences on fruit and vegetable consumption could be modelled. The theoretical point was frequency of consumption, not diversity. Hence, a global index of consumption of fruit and vegetables was required. From the pilot, it seemed to be the case that the question had to use everyday language surrounding food consumption. It also seemed appropriate to move away from multiple choice type questions, to one where the participants gave an open value for consumption.

After much discussion and reworking, the FFQ section, of the questionnaire, was redesigned to incorporate all these issues, which also reduced its size considerably. A diet inventory of fruit and vegetable intake for the last seven days was developed. This revised fruit and vegetable measure was incorporated into the questionnaire[6], which was then ready for the main study (Appendix 7).

5.2.4 Sampling procedure

The 1994 Electoral Register for each area was obtained and used as the sampling frame. While the Electoral Register is a very useful frame, there are problems associated with its use. The main problem lies with the fact that the data is collected every October but not published till February, making the information 4 months out-of-date on publication (Chisnall, 1986). When the current survey was conducted (September - November, 1995) the Electoral Register sampling frame was between 11-13 months out of date.

A systematic, probability sampling approach was taken. Calculating the target sample size involved consideration mainly of the desired accuracy of the survey data, i.e. how much error could be tolerated. DeVaus (1996) details a range of sample sizes with the associated sampling error. For a sample size of approximately 500, the sampling error is 4.5% at 95% confidence level (DeVaus, 1996). This can be interpreted as 95% confidence that the results in the

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[6] This revised measure of fruit and vegetable consumption was not piloted formally, although valuable comments on it were provided by Richard Prentice, Terry Kirk, Vicky Houston and Pam Turner.

population will be the same as those for the sample plus or minus 4.5% (sampling error). To reduce the sampling error, say by half, the general rule of thumb is that the sample would need to be quadrupled (DeVaus, 1996; Coolican, 1994). The benefits of such increases in sample size need to be weighed against the costs (financial, time, etc.). The other main consideration is given to the nature of desired comparisons of sub-groups within the sample. The general rule is that there should be around 50-100 participants per sub-group. For this study, location was a key variable for comparison. It was thus believed that the target sample should be 500, with 125 individuals in each location. This would result in an acceptable level of sampling error. With a projected 50% participation rate, a total sample size of 1000 (250 per area) was selected, providing around 125 individuals in each group.

The sampling interval for each area was devised by taking the total population for each ward/postcode, and dividing this by 250 (the desired sample for each area). These sampling intervals are outlined in Table 5.3.

Table 5.3 Population size and sampling interval for each study area

Area	*Population size (from electoral register)*	*Sampling interval*
Lawrence Hill	8495	34
Easton	7575	30
G44.5	8002	32
G14.0	5938	24

The sample was drawn by using this sampling interval, starting at a random point between 1 and 10 each, which was different for each area (Robson, 1993), hence systematic probability sampling.

This initial sample of 1000 (250 per area) received a letter in advance informing them of the study (Appendix 8). On arrival the author explained the aims of the study, how to complete the questionnaire and dealt with any questions. A suitable collection time was arranged at this point. The questionnaire was conducted during September - November 1995. This was thought to reduce bias resulting from inflated favourable attitudes and opinions to fruit and vegetable consumption more likely in the summer months.

The drop and collect method was used (Fowler, 1993). This method was favoured for a number of reasons. First, it was felt due to the nature of the questionnaire personal interaction with respondents was necessary to build rapport, and enhance completion rates (normally associated with face-to-face interviews). However, because the study was being carried out in an area unknown to the researcher (and also in areas of relative disadvantage) it was felt from a safety point of view it was undesirable to be entering respondents' homes. By adopting this method the advantages of other methods were achieved (e.g. participants allowed to complete questionnaire in their own time, an advantage of a mail survey), while maintaining fairly good response rates. This approach worked well in the pilot study.

Response rates achieved, as a percentage of those made contact with, were: Bristol advantaged, 65.6%; Bristol disadvantaged, 62.6%; Glasgow advantaged, 77.5%; Glasgow disadvantaged, 74.5%. Overall a response rate, as a percentage of those made contact with, of 71% (390) was achieved. As a percentage of the 1000 letters sent out, 39% participation was achieved. Non-contact was for a number of reasons. Aside from individuals no longer living at the given address (a limitation stemming from the out-of-date nature of the electoral register), the research was severely limited by the time (and resources) available to the researcher to conduct the research, especially in Bristol.

The sample size achieved was lower than that aimed for, although the standard error associated with a sample of 390 is approximately 5% (DeVaus, 1996), not much less than the 4.5% associated with the larger sample. A sample of 390 was considered suitable, especially since each location sub-group had at least the 50 described by DeVaus (1996) as necessary for analysis.

5.2.5 Limitations of quantitative research

The main limitation of the quantitative stage related to the lower response rates in Bristol, which stemmed mainly from time and financial restrictions. However, inequality in sample sizes does not represent a problem for the multivariate analyses required for modelling of fruit and vegetable consumption.

The revised food questionnaire was not piloted in detail. However, colleagues did evaluate it, and the overall feeling was that it would be suitable for the purposes of this study.

The scale of relative deprivation/advantage appeared an appropriate method for selection of area, although the reliability and validity of the scale were not tested.

Issues of reliability and validity in this context would relate to whether or not the areas were disadvantaged or advantaged, and whether the areas, matched in each of Bristol and Glasgow, were sufficiently similar. This was particularly an issue for the Bristol area, where the researcher had no background knowledge of the location, and therefore idea of accuracy of chosen areas. On arrival in Bristol, it became clear, to the author, that some parts of Easton (diagnosed from the 'relative deprivation/advantage' scale as more advantaged) were of similar social background to Lawrence Hill. This was because these were geographically neighbouring areas, so there was some overlap. However, the social class profile of participants from each of the areas suggests that this was not a significant problem.

5.3 Analysis procedure

5.3.1. Exploratory analysis

Exploratory data analysis was initially undertaken to become more familiar with the data set, believed essential in the effective development, testing and refining of models of fruit and vegetable consumption (Hartwig & Dearing, 1979). The distributions of single variables were first considered, with emphasis placed on normality and skewness, important for informing decision as to the appropriate multivariate techniques to apply. Patterns of missing data were analysed, as was the presence of outliers, as recommended by Tabachnik & Fidell (1996).

An essential stage in exploring the data set was preparing the variables for subsequent analysis. Various measures were taken which are discussed in detail in section 5.6, including transforming and recoding the variables to meet the assumptions of the statistical techniques employed.

5.3.2. Bivariate analysis

The relationships between the categorical variables (mainly the socio-demographic variables and fruit consumption) were explored using the chi-square test statistic (DeVaus, 1996). The levels of the dependent variable were compared across the ordinal motivation, attitude and belief measures using the Mann-Whitney U test, and continuous variables (emerging from a factor analysis, discussed in Section 5.4.3.1) were analysed using two sample t-test statistics (Diamontopoulos & Schlegelmilch, 1997).

5.3.3. Multivariate analysis

The analysis continued, with the aim of identifying the extent to which each of these variables contributed to consumption of fruit and vegetables, and to compare the relative importance of the influencing factors. Multivariate modelling assisted this, with both non-parametric and parametric approaches used. This analysis began with log linear analysis to model the relationships between the significant categorical variables influencing fruit and vegetable consumption, emerging from chi-square analysis. A logistic regression analysis was then conducted, with the dependent variable (fruit consumption) input as a dichotomous variable, and the independent variables in continuous and dummy form[7].

Discriminant analysis was finally conducted to characterise the dependent variable in terms of significant variables emerging from the earlier analyses. In order to develop appropriate models of fruit and vegetable consumption, the discriminant models for those with positive behavioural intent (i.e. some commitment to act, from Bagozzi, 1993) were further developed. These fruit and vegetable models, developed for those with a positive behavioural intention, provided further insights into the factors intervening between behavioural intention formation and behaviour (consumption).

These multivariate statistical tools (log linear, multiple regression, logistic regression and discriminant analysis) were used to confirm the strength and existence of bivariate relationships, and to develop parsimonious models of fruit and vegetable consumption.

Another important function of the various techniques used, was to ensure the validity of the model building process. While there are inherent statistical problems with each of these methods, there are benefits to taking a 'multi-method' approach (Easterby-Smith et al, 1991). This approach provides insights that may have been missed, with use of just one statistical method, and also reduces the risk of type 1 error (i.e. rejecting the null hypothesis when it is true) or type 2 errors (accept the null hypothesis when it is false) (DeVaus, 1996). Further, the resulting model was strengthened through its derivation (and effectively validation) from different statistical techniques. Approaching this research problem from different statistical approaches served to strengthen the models developed, for fruit and vegetable consumption.

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[7] The again refers to the factor variables which are discussed in 5.4.3.1. The socio-demographic variables were recoded as dummy variables.

5.3.4 Treatment of variables

Great care was taken to ensure appropriate statistical tests were conducted. Seven point Likert scales were used in the questionnaire to measure responses to the motivation, attitude and belief statements, which are ordinal in nature. Strictly speaking, such data is not robust enough to be subjected to parametric analysis, although it is frequently used as such in marketing and consumer research studies (Diamontopoulos & Schlegelmilch, 1997). Due to the inherent limitation in treating ordinal data in this way, it was thought appropriate to use a combination of non-parametric and (corresponding) parametric testing to improve validity of findings.

The next section of this chapter goes on to present descriptive statistics, taking as its structure the main categories of variables included in the questionnaire. This provides the basis for the more detailed analysis of each of fruit and vegetable consumption which appears in Chapters 6 and 7.

5.4 Results of exploratory analysis

The first stage in any statistical analysis is to examine the data set, and prepare variables for inclusion in subsequent bivariate and multivariate analysis. In model building it is important that variables do not violate the assumptions of the relevant approaches. The general aim of model building is to achieve the best solution with the fewest variables possible (Tabachnick & Fidell, 1995). It is therefore important that reliable variables are included; unreliable variables degrade an analysis, while reliable ones enhance it.

Prior to analysis, all variables were examined for accuracy of data entry, missing values, outliers and fit between their distributions and the assumption of the multivariate analysis (both parametric and non-parametric).

In selecting parametric methods, especially the multivariate methods, it was essential to consider the distributions of the variables. Treating ordinal data as interval data is fairly common practice in the social sciences (Diamontopoulos and Schlegelmilch, 1997). The parametric techniques are fairly robust, and Diamontopoulos & Schlegelmilch argue that departures from normality need to be pretty severe, to render parametric techniques inappropriate. Nonetheless, the distributions of the variables were closely examined to ensure the appropriate statistical techniques were applied. While the distributions of the variables was important to overall analysis, this was particularly so for variables to be included in multivariate analysis[8].

Summary measures for describing the distribution of the variables are provided. Means and standard deviations are reported throughout; where appropriate values for kurtosis (peakedness of the distribution) and skewness (symmetry of the distribution) are given. These are reported where appropriate in the following univariate analysis.

Outliers are observations with a unique combination of characteristics identifiable as distinctly different from the other observations (Hair et al, 1995: p57). When a few atypical cases or groups are included in a sample they can 'create' a pattern (DeVaus, 1996: 296). For this data set, the only variables that this may have been problematic for were the continuous fruit and vegetable consumption measures; all the other variables were measured on closed scales. This will be discussed in the description of these variables, but overall Hair et al (1995) recommend that outliers should be retained. They argue that while the multivariate model may be improved by deleting such cases, its generalisability would be reduced (i.e. sample is reduced). The concern of the present analysis was comparing consumers in different groups. Deleting outliers may have led to small groups being compared, and might therefore have been problematic. Thus, deletion of outlier cases was avoided.

This section describes the variables, and any treatment of those variables, to ensure the reliability of variables included in the multivariate research.

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[8] Multivariate normality of two variables implies normality of each variable individually. However the reverse is not guaranteed. While two or more variables may display univariate normality they may not be multivariate normal. A situation where each of the variables displays univariate normality will help gain multivariate normality (Hair et al, 1995:64).

5.4.1. Sample characteristics (socio-demographic variables)

The first stage in exploring the data was to describe the characteristics of the participating sample and compare this to census data. Three hundred and ninety people participated in the study. The demographic characteristics of this sample are shown in Table 5.4.

Table 5.4 Summary of key demographic characteristics of the sample

Characteristics		*Frequency (percent of sample)*[a]	*UK Population (Census, 1991) %*	*Characteristics*		*Frequency (percent of sample)*	*UK Population (Census, 1991) %)*
Sex of respondent				Social class group			
	Female	225 (58%)	51.6		I	15 (4.1%)	6.75
	Male	163 (42)	48.4		II	68 (18.5)	30.3
					IIINM	94 (25.5)	12.0
Age					IIIM	86 (23.4)	28.0
	< 25 yrs	35 (9.1)	32.1[b]		IV	41 (11.1)	13.6
	25 -34 yrs	92 (23.9)	16.1		V	15 (4.1)	4.5
	35 - 44 yrs	81 (21.0)	13.6		Other (inc. dependent on state benefit)	49 (13.3)	4.85
	45 - 54 yrs	73 (19.0)	11.7				
	55 - 64 yrs	57 (14.8)	8.45				
	65 - 74 yrs	33 (8.6)	11.05				
	> 75 yrs	14 (3.6)	7.0	Area			
					Bristol adv.	90 (23.1)	n.a.
Housing type					Bristol disadv.	67 (17.2)	n.a.
	Property owned	230 (60.1)	66.1		Glasgow adv.	128 (32.8)	n.a
	Council /local authority	104 (27.2)	21.4		Glasgow disad	105 (26.9)	n.a.
	Private rented	16 (4.2)	12.2	Smoker status			
	Accom. owned by family	33 (8.5)	---		Smoker	138 (36.1)	n.a.
					Non-smoker	244 (63.9)	n.a.

Note: (a) N varies (due to missing values) but is approximately equal to 390
(b) Age from the Media Pocket Book (1997), since Census (1991) provided this information on a different scale.

The achieved sample consisted of 225 females (58% of sample) and 163 males (42% total). The original sample (from the electoral register) contained equal numbers of men and women, reflecting the proportions in the UK populations.. This bias towards women may have been due to either a greater tendency for women to participate in this study (less likely to refuse), and also the greater likelihood of women at home during the call times, receiving the questionnaire for partner, daughter or son to complete. Rather than the anonymity attached to the researcher if no direct contact with participant was made, this may have positively influenced compliance rates. The age distribution seems to be skewed towards the younger age group (< 44 years). The older age profile of the current sample was broadly similar to that found in the general population (Census, 1991). While there were fewer under 25s participating in this study than might be expected from the Census figures, overall, the proportion under 44 was as expected.

Considering the ratio of advantaged participation to disadvantaged participation, for Bristol this was 1.3:1, and for Glasgow 1.2:1. Aside from this greater propensity within the advantaged areas to participation, there was greater participation in Glasgow as compared to Bristol (1.48:1). The higher rate of participation in Glasgow can be explained in terms of resources (time) available to the researcher[9]; in Glasgow, there was a greater opportunity to approach all of sample (i.e. make contact), more than once and for call-backs, resulting in higher response rates.

A normal distribution of social classes was not expected; greater representation of social classes II, IIIN, IIIM and IV would be in fitting with expectations since the areas chosen were at the upper and lower quartile points of the scale (therefore omitting extremes). The sixth category (dependent on state benefits) included retired, unemployed, students and housewife when no occupation was given for spouse/partner[10]. The social class profile was broadly similar to the OPCS figures, with lower proportions of I and V. However, there was a greater proportion of those in 'other' category in the current sample, than in the Census sample.

The greatest proportion of participants owned their own homes, a similar proportion to that in the general population (Census, 1991). There were approximately twice as many non-smokers as smokers in the sample; comparable information about the general population was not available.

Missing data were most evident for the socio-demographic variables. The reasons underlying missing data in this research problem were mainly concerned with actions on the part of the respondent. Refusal to answer questions (hence missing values) appeared to be mainly due to the sensitivity of the question (occupation, education, etc), and secondly for instrument related reasons, such as fatigue, irrelevance and boredom. Non-response rates are shown in Table 5.5.

Table 5.5 *Pattern of missing data in for selected socio-demographic variables*

	Sex (% non-response)	Age (% non-response)	Your occupation (% non-response)	Spouse's occupation (% non-response)	Smoker? (% non-response)
1. Bristol	0.006	2.5	8.2	40.7	3.2
2. Glasgow	0.004	0.004	3.8	31.7	1.3

Clearly the greatest non-response was observed in spouse's occupation category. Although non-response for spouse's occupation was high this information was not actually used in subsequent analysis, unless there was no information provided about the individual's occupation (i.e. 8.2 % in Bristol and 3.8% in Glasgow). Where there was a difference between Glasgow and Bristol, non-response for every socio-demographic variable was higher in Bristol than in Glasgow.

One of the main sampling concerns was that each sub-group being compared contained between 50 and 100 cases. In order to maintain sub-samples of these sizes, it was thought desirable to recode each of the socio-demographic variables to 2 or 3 categories (while preserving the meaning of the variables). Social class was categorised into non-manual (group I, II, and IIIN) and manual (IIIM, IV, V, dependent on state benefit), age was recoded to give 3 categories (<34, 35-54, >55) and place was categorised into two categories (Bristol and Glasgow). The breakdown of these recoded variables is shown in Table 5.6.

Table 5.6 *Summary of recoded demographic characteristics of the sample*

Characteristics	*Frequency (percent of sample)*	*Characteristics*	*Frequency (percent of sample)*
Age		Social class group	
< 34 yrs	127 (33.0)	Non-manual	177 (48.1)
35 - 54 yrs	154 (40.0)	Manual	191 (51.9)
> 55	104 (27.0)		
		Area	
		Bristol	157 (40.3)
		Glasgow	233 (59.7)

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[9] More time was spent in Glasgow (6 weeks as opposed to 2.5 weeks in Bristol), and in days spent data collecting (30 in Glasgow, 16 in Bristol).

[10] When the participant answered 'housewife', social class was assessed using the spouse/partner's occupation

Recoding the variables as above led to the development of sub-groups, within the total sample, each of large enough size to be included in analysis.

5.4.2 Marketing related influences

The main marketing influences, for which measures were included in the questionnaire, related to components of the marketing mix. The questions, included in this section, measured retail outlet types, where fruit and vegetables were bought, distance travelled to purchase, mode of transport to purchase, perceived variety of produce available, perceived expense of produce and perceived availability of produce. Table 5.7 describes the proportions scoring in each category for these variables.

Table 5.7 *Distributions of marketing factors*

Variable	*Percent of sample (n = 390)*	*Variable*	*Percent of sample (n = 390)*
Where fruit bought?	%	Where vegetables bought?	%
Supermarket	61.5	Supermarket	60.9
Market	1	Market	1.0
Greengrocers	36.4	Greengrocers	35.8
Home-grown	0.3	Home-grown	1.0
Other	0.8	Other	1.3
Distance travelled fruit?	%	Distance travelled vegetables	%
< 1 mile	51.7	< 1 mile	52.7
1-3 miles	42.1	1-3 miles	41.6
>3 miles	6.2	>3 miles	5.7
Transport for fruit ?	%	Transport for vegetables?	%
Walk	34.9	Walk	34.6
Car	51.3	Car	51.0
Bus, taxi, others	13.8	Bus, taxi, others	14.4
Variety available fruit	%	Variety available vegetables	%
Poor	12.1	Poor	11.8
Neither	19.2	Neither	23.1
Good	68.7	Good	65.1
Perceived expense of fruit	%	Perceived expense of vegetables	%
Not expensive	23.0	Not expensive	28.1
Neither	21.3	Neither	23.1
Expensive	55.7	Expensive	48.8
Ease of availability of fruit	%	Ease of availability of vegetable	%
Not easily available	6.2	Not easily available	7.2
Neither	5.4	Neither	7.9
Easily available	88.4	Easily available	84.9

Examination of these marketing related variables, shows purchasing patterns for fruit and vegetables to be very similar. Most respondents shop fairly locally (93.8% fruit shopping and 94.3% vegetable shopping conducted within 3 mile radius of home), and most believed purchasing of fruit and vegetables to be fairly easy to accomplish (88.4% for fruit and 84.9% for vegetables). However, it seems to be the case for the overall sample that price is important, with 55.7% and 48.8% agreeing that fruit and vegetables, respectively, are expensive.

Stage 1 of the research (the qualitative stage) suggested that certain socio-demographic variables may have some impact on the influence of marketing-related variables. Thus, each of these marketing variables were cross-tabulated with the socio-demographic variables place and social class (recoded as explained above) to explore the variations in marketing of fruit and vegetables by socio–demographic sub-group. Table 5.8 presents these cross-tabulations, with chi-square statistics reported.

Table 5.8 ***Marketing factors related to fruit consumption by socio-demographic variables***

	Glasgow	Bristol	χ^2	Non Man.	Manual	χ^2
Transport	%	%		%	%	
Car	54.9	45.9	27.8***	60.5	45.0	10.3**
Walk	25.8	48.4		25.4	40.3	
Other	19.3	5.7		14.1	14.7	
Where bought						
S'market	69.7	49.4	16.29***	68.4	55.3	6.66*
G'grocer	28.6	48.1		29.9	42.1	
Other	1.7	2.6		1.7	2.6	
Distance travelled						
< 1 mile	46.8	58.0	n.a.	44.6	56.5	5.69*
1-3 miles	46.8	36.3		47.5	38.7	
>3 miles	6.4	5.7		7.9	4.7	
Variety available						
Poor	14.6	8.3	n.a.	11.3	12.6	n.a.
Neither	20.6	17.2		19.2	18.3	
Good	64.8	74.5		69.5	69.1	
Expense						
Not exp.	26.6	17.8	6.31*	22.0	24.6	n.a.
Neither	22.7	19.1		20.3	22.5	
Expens.	50.6	63.1		57.6	52.9	
Availability						
Not avail.	5.2	7.6	n.a.	4.5	7.9	n.a.
Neither	3.9	7.6		4.0	5.2	
Easily available	91.0	84.7		91.5	86.9	

Key: * = $p<0.05$, ** = $p<0.01$, *** = $p<0.001$, N= 390

The figures reported here are for Glasgow compared to Bristol, and for non-manual social class compared to the manual social class sub-groups, in terms of the marketing influences.

The Glasgow sample was more likely to use the car than the Bristol sample (54.9% compared to 45.9%), where walking was the preferred mode of transport (48.4% in Bristol walked, compared to 25.8% in Glasgow). Within the manual social class groups 45% used the car and 40.3% walked to buy fruit, compared to 60.5% of the non-manual group using the car and 25.4% walking to buy fruit. The non-manual group was also more likely to use the car than the manual, who were more likely to walk.

The type of shops where fruit was purchased showed significant differences between Glasgow and Bristol. The Glasgow sample were more likely to purchase in supermarkets than greengrocers, while the Bristol sample had equal proportions of people buying fruit in supermarkets and greengrocers. Those in the non-manual social class group also made greater use of the supermarkets for fruit purchases; 40.3% of those in manual social class groups bought fruit in greengrocers. There was no significant difference in distance travelled to buy fruit between the Glasgow and Bristol samples. There was a slight difference between non-manual and manual social class groups in distance travelled, with 56.5% of those in manual groups more likely to shop nearer to home ($p = 0.058$). Those in Glasgow were less likely to agree fruit were expensive (50.6% compared to 63.1% from Bristol agreeing), but no social class difference was established. There were no differences between the sub-groups regarding their beliefs about the availability of fruit.

An analysis of vegetable consumption was conducted in the same way, and is shown in Table 5.9.

Table 5.9 Marketing factors related to vegetable consumption by socio-demographic variables

	Glasgow	Bristol	χ^2	NonMan.	Manual	χ^2
Transport	(%)					
Car	54.9	45.2	27.85***	61.0	44.0	11.93**
Walk	25.3	48.4		24.9	40.3	
Other	19.7	6.4		14.1	15.7	
Where bought						
S'market	69.3	48.4	17.25***	67.8	55.6	5.8*
G'grocer	27.7	47.7		29.4	40.2	
Other	3.0	3.9		2.8	4.2	
Distance travelled						
< 1 mile	48.1	58.6	n.a.	45.2	58.1	7.48*
1-3 miles	46.4	35.7		46.9	38.2	
>3 miles	5.6	5.7		7.9	3.7	
Variety available						
Poor	40.8	26.1	9.44**	35.6	34.0	n.a.
Neither	18.9	20.4		20.3	19.4	
Good	40.3	53.5		44.1	46.6	
Expense						
Not exp.	30.9	24.2	n.a.	32.8	24.1	n.a.
Neither	23.6	22.3		20.9	24.6	
Expens.	45.5	53.5		46.3	51.3	
Availability						
Not avail.	6.9	7.6	8.52*	5.6	8.4	2.674
Neither	4.7	12.7		5.6	8.9	
Easily available	88.4	79.6		88.7	82.7	

N= varies but most often around 390, * p<0.05, **p<0.01, ***p<0.001

There were very similar patterns for shopping behaviour for vegetables as for fruit. Again, most vegetable shopping took place in supermarkets in Glasgow compared to Bristol, where 48.4% shopped at supermarkets and 47.7% shopped greengrocers, as were the non-manual social class more likely to use the supermarkets than the greengrocers.

There was no significant difference between Glasgow and Bristol in the distances travelled, although 58.1% of the manual social-class groups shopped locally (within 1 mile of home), compared to 45.2% of the non-manual social class group. Transport use was identical to that for fruit, with the majority in Glasgow (54.9%) using the car, compared to 45.2% in Bristol. Greater car use was also witnessed amongst the non-manual groups, with 61.0% using the car, compared to 44.0% in the manual group using the car. In Bristol, 48.4% walked to buy vegetables, compared to 25.3% in Glasgow; the manual social class group also showed greater proportions walking (40.3%) than in the non-manual social class groups (24.9%).

Variety of vegetables showed significant differences between Bristol and Glasgow, with 53.5% of those in Bristol agreeing variety available was good, compared to 40.3% in Glasgow agreeing with this. However, 88.4% of the Glasgow sample agreed vegetables were easily available, compared to 79.6% in Bristol. There were no significant differences, between the non-manual and manual social class groups, in terms of variety available or overall availability. There were no significant place or class variations in perceived expense of vegetables.

The role of marketing related variables as an influence on fruit and vegetable consumption was assessed in this analysis. This exploratory stage of analysis indicated that there were significant variations in the marketing influences, by place in particular, which may go some way to explaining the differences in levels of consumption by location.

One very important finding from this exploratory analysis was the differences between Glasgow and Bristol in terms of retail outlet type where fruit and vegetables were purchased. Choice of type of retail outlet has an impact in terms of distance travelled, and mode of transport used. The Glasgow sample made great use of supermarkets, generally located out of town (Henson, 1992), and thus requiring some form of transport. In Bristol there was greater support for the local greengrocer, with the sample more likely to walk to do their vegetable and fruit shopping, which may also impact upon the frequency of shopping for fruit and vegetables.

Also of interest is that the patterns of shopping for fruit and for vegetables are similar, i.e. people shop for both in the same places, travelling by the same mode, etc. However, perceived availability of vegetables showed significant differences between Glasgow and Bristol sub-groups, when there was no such difference found for fruit.

This analysis gave a preliminary indication of shopping habits, suggesting differences in behaviour, as a consequence of where people live and their social class. The nature of the influence, of these marketing variables on fruit and vegetable consumption, was examined further, presented in the subsequent chapters.

5.4.3 Motivation, attitude and belief measures

The distributions of the ordinal variables, measuring attitudes, motivations and beliefs, are important in informing decisions as to the types of statistical tests applicable (parametric vs. non-parametric). When the distribution of variables resembles normality, then it is fairly safe to apply parametric techniques to ordinal data. Table 5.10 presents a description of the attitude, motivation and belief variables for fruit, reporting mean, standard deviations, skewness and kurtosis values (important in making judgements as to the normality of distributions). The corresponding values in relation to vegetable consumption are reported in Table 5.11.

Table 5.10 Descriptive statistic for the attitude, opinion and beliefs statements for fruit consumption

Variable	*Mean*	*Std. dev.*	*Skewness*	*Kurtosis*	*Std. error*
FRUIT					
Looks good	6.582	0.868	-3.138	12.893	0.044
Tastes good	6.679	0.806	-3.967	20.321	0.041
Not messy	4.446	1.794	-0.298	-0.650	0.091
Light to carry	3.556	1.911	0.117	-0.932	0.097
Partner likes	5.251	1.624	-0.705	-0.094	0.082
Children's preferences	5.241	1.569	-0.565	-0.160	0.079
Healthy for family	5.885	1.432	-1.237	0.958	0.073
Sets good example	5.303	1.556	-0.599	-0.198	0.079
Is accepted by my family	5.000	1.632	-0.549	-0.116	0.083
Is healthy for me	5.900	1.308	-1.333	1.745	0.066
Fits in with eating habits	5.510	1.554	-0.963	0.426	0.079
Improves appearance	4.726	1.635	-0.330	-0.296	0.083
Helps lose weight	4.459	1.756	-0.325	-0.499	0.089
Helps maintain weight	4.646	1.757	-0.473	-0.384	0.089
Is good for skin	5.097	1.659	-0.774	0.142	0.084
Cheers me up	4.433	1.730	-0.345	-0.354	0.088
Is interesting	4.797	1.661	-0.592	-0.113	0.084
Has a variety of textures	4.990	1.665	-0.595	-0.183	0.084
Has a variety of flavours	5.574	1.423	-0.964	0.714	0.072
Is comforting	4.467	1.699	-0.320	-0.368	0.086
Is convenient	5.274	1.548	-0.830	0.279	0.078
Fits a medically supervised diet	4.285	1.924	-0.209	-0.757	0.097
Involves a lot of waste	3.018	1.807	0.461	-0.982	0.092
Time to prepare	2.179	1.527	1.361	1.206	0.077
Time to shop	2.379	1.627	1.122	0.379	0.082
Makes a good snack	6.200	1.297	-2.288	5.594	0.066
If filling	5.046	1.611	-0.654	-0.308	0.082
Is expensive	4.587	1.777	-0.458	-0.622	0.090
Easily available	5.979	1.362	-2.005	4.215	0.069
Subjective Norm	5.454	1.609	-1.084	0.718	0.081
Protects against ill-health	5.359	1.457	-0.791	0.555	0.074
Behavioural intention	5.156	1.517	-0.591	0.128	0.077

N = 390

Table 5.11 Descriptive statistics for the attitude, opinion and beliefs statements regarding vegetable consumption

Variable	*Mean*	*Std. dev.*	*Skewness*	*Kurtosis*	*Std. error*
VEGETABLES					
Looks good	6.562	0.932	-3.176	12.586	0.047
Tastes good	6.574	0.915	-3.150	12.122	0.046
Not messy	4.377	1.807	-0.271	-0.687	0.091
Light to carry	3.538	1.827	0.135	-0.743	0.093
Partner likes	5.372	1.570	-0.851	0.298	0.080
Children's preferences	5.182	1.556	-0.557	-0.063	0.079
Healthy for family	5.787	1.457	-1.131	0.815	0.074
Sets good example	5.313	1.524	-0.600	-0.054	0.077
Is accepted by my family	5.046	1.628	-0.621	-0.032	0.082
Is healthy for me	5.938	1.317	-1.353	1.733	0.066
Fits in with eating habits	5.600	1.448	-0.969	0.571	0.073
Improves appearance	4.759	1.624	-0.370	-0.204	0.082
Helps lose weight	4.477	1.788	-0.370	-0.471	0.091
Helps maintain weight	4.679	1.720	-0.479	-0.289	0.087
Is good for skin	5.010	1.712	-0.677	-0.078	0.087
Cheers me up	4.174	1.627	-0.201	-0.095	0.082
Is interesting	4.833	1.669	-0.537	-0.235	0.085
Has a variety of textures	5.128	1.597	-0.737	0.171	0.081
Has a variety of flavours	5.559	1.438	-1.079	1.101	0.073
Is comforting	4.346	1.696	-0.250	-0.381	0.086
Is convenient	4.905	1.649	-0.616	-0.150	0.083
Fits a medically supervised diet	4.285	1.880	-0.214	-0.661	0.095
Involves a lot of waste	3.818	1.953	-0.096	-1.269	0.099
Time to prepare	3.697	1.828	-0.051	-1.166	0.093
Time to shop	2.744	1.651	0.707	-0.359	0.084
Makes a good snack	4.236	1.774	-0.144	-0.992	0.090
If filling	5.287	1.587	-0.941	0.137	0.080
Is expensive	4.346	1.767	-0.285	-0.711	0.089
Easily available	5.887	1.389	-1.594	2.246	0.070
Subjective Norm	5.508	1.584	-1.055	0.589	0.080
Protects against ill-health	5.479	1.446	-0.846	0.404	0.073
Behavioural intention	5.069	1.530	-0.415	-0.327	0.077

N = 390

Because of the tendency towards higher scoring on the attitude variables, some of these variables appeared to be negatively skewed. Examination of the kurtosis and skewness scores suggests this is only significantly different from normal for 2 variables for each of fruit and vegetables. When this is the case square root transformations can be applied to achieve normality (positively skewed distributions are best transformed through a logarithmic transformation). The square root transformations were applied to those variables measuring 'fruit looks good' (skewness –3.138, kurtosis 12.893, sig. 0.044); 'fruit tastes good' (skewness -3.967, kurtosis 20.324, sig. 0.041); 'vegetables look good' (skewness -3.176, kurtosis12.586, sig. 0.047) and 'vegetables taste good' (skewness -3.150, kurtosis 12.122, sig. 0.046), which were all significantly different from normal.

However, these transformations produced values for kurtosis and skewness which showed even greater non-normality. For this reason the variables displaying non-normality were included in their original way, but caution was exercised in the interpretation of these variables.

5.4.3.1 Factor analysis

The earlier stages in the research (the literature review and the qualitative research) lead to the conclusion that many of the motivation, attitude and belief variables were important influences on fruit and vegetable consumption. However, there were many such variables in this analysis, so it was desirable to summarise the influence of these variable on fruit and vegetable consumption. Correlational analysis of these variables suggested some were closely related. Due to this effect (i.e. that there may be some variables which are measuring similar constructs), it seemed appropriate to reduce these variables to the underlying structure of dimensions which best explained their relationship, as suggested by Hair et al (1995). With many statements designed to measure attitudes, opinions and beliefs, it was useful to reduce the original, unrecoded variables to a few underlying dimensions which best described the data (Alt, 1990). Factor analysis was used to produce these dimensions, where a factor is a dimension or construct which is a condensed statement of the relationships between a set of variables. Factor analysis is an interdependence technique, where all the variables are considered simultaneously, relative to each other (Hair et al, 1996). The factor construct is operationally defined by its factor loadings (i.e. the correlation of a variable with a factor) (Kline, 1994). Principal component analysis (PCA) is a form of factor analysis, which aims to estimate the correlation matrix, by finding the characteristic equation of the matrix. PCA maximises the variance explained by any number of variables (Kline, 1994). The eigenvalue represents the amount of variance accounted for by a factor or principal component (Hair et al, 1996). For this analysis the ordinal variables were analysed as if they were interval (as in Hair et al, 1995).

5.4.3.2 Rotation of factors

The initial PCA is the direct method of extracting factors, and is a result of applying a procedure to extract factors orthogonally from the correlation matrix. This may not produce the best picture of interrelations between the set of variables however, and it is essential to rotate the factors in order to reduce ambiguities (Alt, 1990).

Rotation is when the factors, or reference vectors, are turned about their origin through space. Simplest is orthogonal (i.e. kept at 90°), but it is possible to rotate through oblique angles (known as an oblique rotation). When it is suspected that the factors may be correlated, then an oblique rotation is appropriate (Kline, 1994). For this data set, the factor correlation matrix indicated some correlations greater than 0.3, suggesting that some factors were correlated. Thus an oblique rotation was most suitable.

The oblique rotation solution provides the unique relationship between the variables and the factors. The unique variance explained by each factor is provided; however, when conducted with SPSS statistical package, these values are given for *before* rotation, when there is, most likely, some overlap between factors. Thus, due to correlation of factors, these values can only give some indication of variance explained by the factors.

Since the factor analysis was run on variables which were slightly negatively skewed, possibly jeopardising the reliability of this analysis, the reliability of each group of variables, included in the factor analysis, is reported (alpha coefficients of reliability), as well as a discussion of the underlying factor structure in terms of the model from Figures 2.8 and 4.1.

5.4.3.3 Interpretation of PCA

The 'factor structure' gives the correlations of the original variables with each principal component. The PCA produced 8 principal components, which best described the relationships between the variables. These were selected along two criteria, advised by Alt (1990). Firstly, the factor solution had to describe the majority of the variance (anything from 50-75% is acceptable; here 8 factors explain 65.4%) and eigenvalues had to be greater than 1 for factors to be selected. Table 5.12 shows the eight factors alongside the original attitude, opinion and beliefs statements that appeared in each of the dimensions. It also details the factor loading and the percentage variance explained by each factor.

Table 5.12 Factor analysis of motivation, attitude and belief variables for FRUIT consumption.

Factor no./Description 'Attitude and belief statements'	Factor loading	Eigenvalue	% var. (cum. % var.)
1/ Medium-term motivations		8.696	27.2
It keeps me healthy	0.467		(27.2)
It fits in with my eating habits	0.468		
It improves my overall appearance	0.804		
It helps me lose weight	0.827		
It helps me maintain my weight	0.863		
It is good for my skin	0.789		
2/ Product preparation		2.811	8.8
There is a lot of waste when you buy fruit	0.706		(36.0)
Fruit takes a long time to prepare	0.836		
Fruit takes a long time to shop for	0.825		
3/ Family influences		2.197	6.9
My spouse/partner likes it	0.764		(42.8)
My children like it	0.831		
It is healthy for my family	0.784		
It sets a good example for my family	0.786		
It is accepted by other members of my family	0.764		
4/ Suitability of fruit as a snack		1.900	5.9
Fruit makes a good snack	0.711		(48.8)
Fruit is filling	0.664		
Fruit is expensive	0.464		
Fruit is easily available	0.529		
5/ Quality		1.635	5.1
It looks like good quality	0.857		(53.9)
It tastes good	0.871		
6/ Hedonic motivations		1.369	4.3
It cheers me up	0.755		(58.2)
It is interesting	0.821		
It has a variety of textures	0.821		
It has a variety of flavours	0.768		
It is comforting to eat	0.743		
7/ Convenience		1.264	4.0
It is not messy to eat	0.856		(62.1)
It is light to carry	0.822		
8/ Longer term motivations		1.062	3.3
People who are important to me think eating fruit is a good thing	-0.664		(65.4)
Eating fruit can protect me against illness in later life	-0.854		
I intend to eat more fruit within the next year	-0.797		

The eight factors emerging from this analysis represent the underlying pattern of responses within the data set. The most important factor within fruit consumption is that which is best described as summarising 'medium-term motivations'. The variables included in this factor were those which were measuring appearance related motivations, as well as how easily eating fruit fitted existing habits. The second factor was 'product preparation' which captured those variables measuring preparation related aspects of the product. 'Family influences' was the third factor, which captured the family's preferences and acceptance, as well as the sense of protection for them. The fourth factor is less easy to define, but essentially captures the 'suitability of fruit as a snack', and the variables loading on this would suggest this is in terms of satiety, expense and availability. Factor five related to 'quality' in terms of both appearance and taste, while factor six embodies 'hedonic motivations'. Included in this factor are variables aiming to measure attributes offered by fruit such as comfort, interest and variety (texture and flavour). The seventh factor incorporates the 'convenience' aspects of fruit, covering messiness and weight of carrying produce. The final factor, which explains least variance (3.3%) encompasses the items associated with the Theory of Planned Behaviour, i.e. behavioural intention and subjective norm. Beliefs relating to protective effects of fruit loaded highest on this factor, followed by the behavioural intention measure. For this reason, this factor was labelled 'longer term motivations'.

The variables loading on factor eight had negative values; these values were recoded so they had a positive loading along the factor. Interpretation was thus eased, since all factors were in the same direction, i.e. positive scores indicated agreement with factor, while negative scores indicated disagreement. Factors were saved as variables, resulting in 'latent' factor variables, which were not directly measured, but in combination represent some construct (Hair, et al, 1995). To ensure these factors did indeed represent what the variables loading along it suggested, reliability tests were run. These are presented in Table 5.13.

Table 5.13 ***Reliability measures of motivations, attitudes and belief represented by factors, FRUIT consumption.***

Factor no./ Description 'Attitude and belief statements'	Alpha	Alpha if item deleted
1/ Medium-term motivations	0.8736	
It keeps me healthy		0.8666
It fits in with my eating habits		0.8752
It improves my overall appearance		0.8360
It helps me lose weight		0.8468
It helps me maintain my weight		0.8404
It is good for my skin		0.8419
2/ Product preparation	0.7297	
There is a lot of waste when you buy fruit		0.7494
Fruit takes a long time to prepare		0.5716
Fruit takes a long time to shop for		0.6107
3/ Family influences	0.8558	
My spouse/partner likes it		0.8443
My children like it		0.8201
It is healthy for my family		0.8216
It sets a good example for my family		0.8095
It is accepted by other members of my family		0.8341
4/ Suitability of fruit as a snack	0.5047	
Fruit makes a good snack		0.2978
Fruit is filling		0.3188
Fruit is expensive		0.6205
Fruit is easily available		0.4612
5/ Quality	0.8254	n.a.[11]
It looks like good quality		
It tastes good		
6/ Hedonic motivations	0.8618	
It cheers me up		0.8278
It is interesting		0.8129
It has a variety of textures		0.8262
It has a variety of flavours		0.8540
It is comforting to eat		0.8408
7/ Convenience	0.7348	n.a.
It is not messy to eat		
It is light to carry		
8/ Longer term motivations	0.7405	
People who are important to me think eating fruit is a good thing		0.7507
Eating fruit can protect me against illness in later life		0.5935
I intend to eat more fruit within the next year		0.6198

[11] With the deletion of one item then only one would remain, having a value of 1.0. This is always the problem when there are only 2 items mainly loading on a factor.

The alpha values give an indication of the internal consistency of the factor, i.e. the consistency of the results across individual items comprising the composite scale (Diamontopoulos & Schlegelmilch, 1997). The value for 'alpha if item deleted' gives an indication of the contribution of each item to the overall factor; the lower the alpha value once it is deleted then the greater its contribution to the overall factor construct.

An alpha rating of 0.7 or above was considered highly reliable (Hair et al, 1995). It was clear that the latent factors did reliably capture the meaning of the variables loading on them. All alpha scores were above 0.7, except that for factor 4, 'suitability as a snack'. However, the variables which gave the greatest correlation with this factor, and were therefore most reliable, were those two relating specifically to this issue, namely 'fruit makes a good snack' and 'fruit is filling'. Thus, it was believed that this factor did capture the meaning of this construct reliably.

The reliability values suggested that problems, encountered with incorporating variables in a factor analysis when not exactly normally distributed, were limited. The 8 factors produced were reliable, and of a nature expected from the data. Compared to the models emanating from the literature review (Figure 2.3) and the qualitative stage (Figure 4.1), a similar categorisation of influences into internal, external and marketing related emerged. Of the internal influences, the factor structure suggested that motivations to consume were important. 'Medium term motivations' explained most of the variation within the data set, followed by 'hedonic motivations' and then 'longer term motivations'. Of the marketing-related variables, 'product related influences' were also very important, in particular relating to product preparation and convenience. External influences of importance were the 'family influences', followed by the incorporation into existing 'meal structures', represented here by the suitability as a snack.

The factor analysis was also conducted for the variables measuring attitudes and beliefs in relation to vegetables. The initial PCA displayed 8 factor rotations, selected along the same criteria as for fruit (namely, the solution described the majority of the variance, and eigenvalues were greater than 1). Table 5.14 shows the eight factors alongside the original attitude, opinion and beliefs statements that appeared in each of the dimensions, with details of the factor loadings and the percentage variance explained by each factor.

Table 5.14 ***Factor analysis of motivation, attitude and belief variables for VEGETABLE consumption.***

Factor no./ Description 'AOB statements'	Factor loading	Eigen-value	% var. (cum. % var.)
1/ Medium-term motivations		9.319	29.1
It keeps me healthy	0.57911		(29.1)
It fits in with my eating habits	0.54156		
It improves my overall appearance	0.81721		
It helps me lose weight	0.86113		
It helps me maintain my weight	0.85973		
It is good for my skin	0.81456		
2/ Product preparation		2.808	8.8
There is a lot of waste when you buy vegetables	0.79812		(37.9)
Vegetables take a long time to prepare	0.83084		
Vegetables take a long time to shop for	0.73907		
Vegetables are expensive	0.53327		
3/ Quality		2.137	6.7
They look like good quality	0.90585		(44.6)
They taste good	0.90388		
4/ Family influences		1.884	5.9
My spouse/partner likes them	0.78438		(50.5)
My children like them	0.84227		
They are healthy for my family	0.79957		
They set a good example for my family	0.83748		
They are accepted by other members of my family	0.75494		
5/ Longer term motivations		1.751	5.5
People who are important to me think eating veg is a good thing	0.57629		(55.9)
Eating veg. can protect me against illness in later life	0.77274		
I intend to eat more veg. within the next year	0.85166		
(Vegetables are easily available)	0.71585		
6/ Hedonic motivations		1.358	4.2
They cheer me up	-0.78769		(60.2)
They are interesting	-0.81325		
They have a variety of textures	-0.76419		
They have a variety of flavours	-0.70298		
They are comforting to eat	-0.77228		
7/ Convenience		1.223	3.8
They are not messy to eat	0.84475		(64.0)
They are light to carry	0.79795		
8/ Suitability of veg as a snack		1.022	3.2
Vegetables make a good snack	-0.78226		(67.2)
Vegetables are filling	-0.80526		

The factor structure for vegetables was similar to that for fruit, and reflected the main constructs of the fruit and vegetables models, i.e. internal influences, external influences and marketing influences. However, the amount of variance explained by each factor was different, i.e. different factors had different levels of importance for vegetables, compared to fruit. Factors relating to 'medium term motivations', 'preparation', 'hedonic' and 'convenience' explained very similar amounts of variance for both fruit and vegetables, occupying the same positions. 'Family influences' occupied a similar position for both vegetables and fruit, although slightly higher for fruit. 'Suitability of vegetables as a snack' did not explain much variance for vegetables (3.2%), but more for fruit (5.9%), as might be expected. 'Quality' accounted for more variance for vegetables (6.7%) than fruit (5.1%), and 'longer term motivations' were greater for vegetables (5.5%) than for fruit (3.3%).

Factors 6 and 8 both had inverse loadings, so were recoded to give positive values, again, easing interpretation. As before, all positive scores indicate agreement with factor, while negative scores indicate disagreement. Again, the factor scores were saved as variables. Reliability of these factors was also examined as shown in Table 5.15.

Table 5.15 ***Reliability measures of motivations. attitudes and beliefs represented by factors, VEGETABLE consumption.***

Factor no./ Description 'AOB statements'	Alpha	Alpha if item deleted
1/ Medium-term motivations	0.8837	
It keeps me healthy		0.8763
It fits in with my eating habits		0.8850
It improves my overall appearance		0.8498
It helps me lose weight		0.8592
It helps me maintain my weight		0.8556
It is good for my skin		0.8508
2/ Product preparation	0.7121	
There is a lot of waste when you buy vegetables		0.7450
Vegetables take a long time to prepare		0.5999
Vegetables take a long time to shop for		0.5857
Vegetables are expensive		0.6444
3/ Quality	0.8697	n.a.
They look like good quality		
They taste good		
4/ Family influences	0.8668	
My spouse/partner likes them		0.8485
My children like them		0.8335
They are healthy for my family		0.8394
They set a good example for my family		0.8223
They are accepted by other members of my family		0.8501
5/ Longer term motivations	0.7381	
People who are important to me think eating veg is a good thing		0.6344
Eating veg. can protect me against illness in later life		0.6010
I intend to eat more veg. within the next year		0.6830
(Vegetables are easily available)		0.7714
6/ Hedonic motivations	0.8536	
They cheer me up		0.8239
They are interesting		0.8067
They have a variety of textures		0.8147
They have a variety of flavours		0.8360
They are comforting to eat		0.8340
7/ Convenience	0.7152	n.a.
They are not messy to eat		
They are light to carry		
8/ Suitability of veg as a snack	0.6187	n.a.
Vegetables make a good snack		
Vegetables are filling		

Again, all the latent factors appear to reliably capture the meaning of the variables loading on them. All alpha scores are over 0.7, except that for factor 8, which is just below. For factor 5 (longer term motivations) the results show that exclusion of the availability item only slightly reduces the reliability of that factor. Hence, factor 5 was thought to reliably capture 'longer term motivations', and the 'vegetables are easily available' considered an unimportant item contributing to this factor.

5.4.3.4 Factors saved as variables for subsequent analysis

The principal components were saved as variables for inclusion in subsequent analysis. These variables were not directly measured and for this reason are referred to as *latent* variables. The distributions of these variables was examined and are presented in Table 5.16.

Table 5.16 ***Test for normality, skewness and kurtosis for latent variables***

FRUIT			VEGETABLE		
Variable	*Skewness values*	*Kurtosis values*	*Variable*	*Skewness values*	*Kurtosis values*
1. Medium-term motivations	-0.498	0.304	1. Medium-term motivations	-0.447	-0.223
2. Product preparation	0.750	0.219	2. Product preparation	-0.009	-0.527
3. Family	-0.733	0.623	3. Quality	-2.977	12.770
4. Suitability as a snack	-1.538	5.231	4. Family	-0.753	0.699
5. Quality	-3.317	17.492	5. Longer term motivations	-0.946	1.619
6. Hedonic	-0.557	0.584	6. Hedonic	-0.420	0.460
7. Convenience	-0.098	-0.537	7. Convenience	0.019	-0.408
8. Longer term motivations	-0.865	1.351	8. Suitability as a snack	-0.352	-0.111

N = 390

Each of the variables broadly fitted normality (Hair et al, 1995), except factor 5 for fruit and factor 3 for vegetables, which were both negatively skewed. These were both latent variables measuring 'quality'. A square root transformation was applied to correct for this. This gave values of skewness and kurtosis of –0.449 and 00.772 respectively for fruit, and –0.183 and – 0.015 respectively for vegetables.

Approximating normality, the factor variables were included in the parametric multivariate analysis. Where they were included in non-parametric analysis they were recoded into 4 categories, along the quartile points. Labels ranged from low rating (1) through to high rating (4). This set of ordinal variables was used in the bivariate analysis and the log linear modelling. For the parametric modelling (i.e. the discriminant analysis) the variables were left in continuous (metric) form.

5.4.4 Consumption levels

Consumption of fruit and vegetables was measured in continuous form. Table 5.17 shows the summary descriptive statistics for the consumption variables.

Table 5.17 Descriptive statistics for fruit consumption

	Mean	*Std. dev.*	*Skewness*	*Kurtosis*	*Std. error*
Fruit consumption	6.627	5.958	2.312	6.898	0.303
Vegetable consumption	5.755	3.144	1.987	10.791	0.160

The dependent consumption variables were non-normal. A logarithmic transformation was applied to both (as both were positively skewed), leading to normal distributions for both fruit (skewness –0.041, kurtosis 0.123) and vegetables (skewness -0.710, kurtosis 1.452) consumption. However, this poses certain problems at an interpretative level, since this transformation suggests an exponential scale, which is difficult to interpret.

The other main concern in treatment of the consumption variables related to the reliability of this measure. As described in Section 5.2.1.2, a dietary inventory of fruit and vegetable consumption was used to measure fruit and vegetable consumption, most useful when a broad indication of consumption is required (Anderson, 1995). It is not a very reliable measure of *actual* consumption levels. For these reasons, it was considered preferable to group consumers by level of consumption, initially 5 categories, and then into low and medium-high. This categorisation of fruit and vegetable consumption, into two categories, was used as the dependent variable in the statistical analysis.

Appropriate multivariate analysis, which incorporated a dependent grouping variable, was applied. Discriminant analysis was an appropriate multivariate analysis, as it relies on a grouping dependent variable. Recoded consumption variables (of medium-high and low consumption) were included in the discriminant and non-parametric analysis. Initial exploratory analysis of levels of consumption by demographic sub-group, suggested there were differences in levels of consumption based on age, class and place, shown in Table 5.18.

Table 5.18 ***Consumers of fruit by demographic sub-group***

	None %	*V/Low* 1-2 times per week %	*Low* 3-4 times per week %	*Medium* 5-7 times per week %	*High* > once per day %
All	3.1	14.4	27.4	32.8	21.3
Bristol	4.5	13.6	19.5	39.0	23.4
Glasgow	2.2	15.1	33.2	29.3	20.3
Vegetarian	4.2	12.5	12.5	25.0	45.8
Non-vegetarian	3.1	14.4	28.9	33.9	19.7
<34	3.1	15.0	29.9	30.7	21.3
34-54	3.9	15.0	32.7	26.8	21.6
>55	1.9	13.5	17.3	46.2	21.2
Male	1.9	18.5	24.1	37.7	17.9
Female	4.0	11.7	30.5	30.0	23.8
Property owned	1.7	14.3	27.0	34.3	22.6
Council/local authority housing	3.9	19.4	29.1	30.1	17.5
Privately rent	8.2	6.1	26.5	36.7	22.4
I, II	2.4	9.6	22.9	37.3	27.7
IIIN	2.1	9.6	30.9	37.2	20.2
IIIM	0	19.8	31.4	34.9	14.0
IV, V	3.6	20.0	27.3	27.3	21.8
VI (Unemployed, students)	6.1	18.4	28.6	20.4	26.5
Smoker	5.1	19.0	35.0	26.3	14.6
Non-smoker	2.0	12.3	22.5	37.7	25.4
Those with children aged:					
Under 4	1.4	10.1	33.3	37.7	17.4
5 - 11 years	3.2	12.8	34.0	30.9	19.1
12- 17 years	3.4	14.9	34.5	36.7	19.8
No children	3.0	16.3	22.2	35.5	23.2

Note: N = 390 in for most variables. When less it is due to missing values

This analysis, by sub-group, provided some very interesting results. All proportions reported are the percent within each sub-group with different levels of consumption..

There were regional differences in fruit consumption, with 62.4% of the Bristol sample consuming fruit 5-7 times per week, compared to 49.6% in Glasgow achieving this level. In Glasgow 48.3% indicated low or very low consumption (the comparable levels for Bristol was 37.6%).

Highest fruit consumption was among I/II social class groups, with lowest among IIIM/IV/V. Surprisingly, students and unemployed appeared to have high consumption. This could be due to the presence of students, who are likely to be on low income, but their social status (based on their parents' occupation) would be higher.

While 23.8% of women had high consumption (i.e. greater than once per day), men and women, on balance, had very similar consumption levels and patterns. Fifty-five percent of men consumed fruit at least 5-7 times per week, compared to 53.8% of women consuming this level of fruit.

The presence of children had a negative influence on overall fruit consumption, with those without children tending towards higher consumption.

The oldest age cohort appeared to have the greatest fruit consumption (67.5% with medium or high consumption). The two younger age groups both tended towards lower consumption, with 48% of those under 34 consuming fruit at the most 3-4 times per week, 51.6% of 35-54 consuming this level, and only 32.7% of the older age group consuming this amount of fruit.

Smokers had considerably lower fruit consumption than non-smokers. The majority of non-smokers consumed at least 5-7 times per week (63.1%), while only 40.9% of smoker achieved this level of consumption.

Those in council or local authority housing had a considerably lower incidence of medium and high fruit consumers (47.6%) than home owners (56.9%) or private renters (59.1%). Vegetarians had a very high fruit consumption (more than double the average), most likely linked to their (expected) high vegetable consumption (see Table 5.19).

In trying to establish the similarities and differences between fruit and vegetable consumption a similar table was constructed for vegetable consumption.

Table 5.19 ***Consumers of vegetables by demographic sub-group***

	None %	*V/Low* 1-2 times per week %	*Low* 3-4 times per week %	*Medium* 5-7 times per week %	*High* > once per day %
All	2.6	8.5	20.3	58.7	9.0
Bristol	1.9	6.5	24.0	59.1	8.4
Glasgow	3.0	9.9	18.1	59.5	9.5
Vegetarian	4.2	0	8.3	62.5	25.0
Non-vegetarian	2.5	9.2	21.1	59.2	8.1
<34	5.5	14.2	22.8	51.2	6.3
34-54	0.7	6.5	23.5	57.5	11.8
>55	1.9	4.8	12.5	72.1	8.7
Male	3.1	13.0	21.6	52.5	9.9
Female	2.2	5.4	19.7	64.1	8.5
Property owned	1.3	7.8	18.7	61.7	10.4
Council/local authority housing	3.9	11.7	23.3	56.3	4.9
Privately rent	6.1	6.1	20.4	55.1	12.2
I, II	0	3.6	14.5	66.3	15.7
IIIN	1.1	8.5	16.0	68.1	6.4
IIIM	3.5	10.5	25.6	57.0	3.5
IV, V	3.6	12.7	20.0	52.7	10.9
VI (Unemployed, students)	8.2	12.2	24.5	42.9	12.2
Smoker	1.5	10.2	24.1	59.9	4.4
Non-smoker	3.3	7.4	18.0	59.4	11.9
Those with children aged:					
Under 4	4.3	14.5	15.9	56.5	8.7
5 - 11 years	4.3	7.4	26.6	50.0	11.7
12- 17 years	3.4	4.6	25.3	55.2	10.3
No children	1.5	8.9	17.2	64.3	8.4

Note: N = 390 in for most variables. When less it is due to missing values

There was not much difference between Glasgow and Bristol, although Glasgow did have a greater incidence of none or very low consumption (12.9%).

Those in the higher social class groups had higher vegetable consumption; 15.7% were eating vegetables more than once a day, while only 3.5% of IIIM were eating this much. Eighty-eight percent of the social class groups I and II were eating vegetables at least 5-7 times per week, compared to only 55.1% of unemployed and students who managed this level of consumption.

Women had a greater incidence of vegetable consumption (72.4% medium/high) than men (62.4% medium/high). Vegetarians had very high vegetable consumption (almost 3 times the average), as was expected. Those without children had greater incidence of vegetable consumption (72.7% medium/high) than those with. Those with children under 4 have a high incidence of very low consumption.

Vegetable consumption varied by age. The oldest age sub-group appeared to have the greatest vegetable consumption (80.8% with medium or high consumption), with lowest consumption among the youngest group (37.0% very low or low). Of those under 34, 19.7% consumed less than 2 portions per week.

Non-smokers had a greater incidence of high vegetable consumption than non-smokers. Smokers have well below average incidence of high consumption, and above average incidence of low consumption. Home-owners had the highest incidence of high vegetable consumption (72.1% medium/high), while those in council or local authority housing had a considerably lower vegetable consumption (35.0% low/very low).

While these patterns look similar, it seems that fruit and vegetable consumption were influenced by different socio-demographic variables. The nature of the influences of socio-demographic variables on fruit and vegetable consumption is further explored in Chapters 6 and 7.

5.5 Conclusion

This chapter has outlined the processes involved in the survey of fruit and vegetable consumption, to develop a model of this consumption behaviour. The method adopted was described and explained. To ensure the reliability of the models produced, it was important to examine the data set, to ensure appropriate statistical analyses were employed

The exploratory analysis suggested:

1. Many variables are non-normally distributed, and the modelling approaches, selected, should allow for this (i.e. non-parametric statistics most appropriate)
2. Analysis of the marketing related influences suggested fruit and vegetables were purchased in broadly similar ways (in terms of distance travelled, type of shop, etc.).
3. The principal component analysis showed that while there were similar underlying constructs to fruit and vegetable consumption, the relative importance of these constructs varied for fruit and vegetables.
4. Certain socio-demographic variables seem to influence fruit and vegetable consumption, with place, age and smoker status important influences on fruit consumption, and age and social class more relevant for vegetable consumption.

While there are some similarities, between fruit and vegetable consumption behaviour, there are also differences. This leads to the pertinent question as to whether fruit and vegetables should be treated separately or in combination. Both the qualitative stage of the research, and the factor analysis results, suggested that *how* fruit and vegetables are consumed differs. As developing models of consumption was the main concern of this thesis, it seemed appropriate to develop and present separate models for fruit and vegetable consumption behaviour.

The next chapters present the model building procedures, for fruit (Chapter 6) and vegetable consumption (Chapter 7), modelling these behaviours in terms of the variables described above.

Chapter 6 Fruit consumption model

6.1 Introduction

The main research objective was concerned with building a model of fruit and vegetable consumption behaviour. This chapter outlines the procedures leading to the development of a model of fruit consumption. The objectives set out in Chapter 5 form the basis of this procedure.

1. To establish the most salient variables influencing fruit consumption.
2. To identify the extent to which each of these variables influences fruit consumption.
3. To compare the relative importance of the factors influencing fruit consumption

Each of these objectives are taken in turn, with this chapter presenting the findings for fruit consumption and the following chapter presenting the vegetable model.

6.2 Salient variables influencing fruit consumption

Bivariate analysis was conducted to give an indication of the important variables influencing fruit consumption. As discussed in Section 5.4, the socio-demographic variables were categorical, the motivation, attitude and belief variables were ordinal, the latent variables emerging from the principal components analysis of these variables were interval, and the dependent variable (fruit consumption) had been grouped into two categories.

6.2.1 Socio-demographic variables

The initial descriptive analysis of fruit consumption by socio-demographic variables (reported in section 5.4.4.) suggested that there were differences in fruit consumption by socio-demographic sub-group. These relationships were further explored using the chi-square test for contingency. Table 6.1 presents findings of the chi-square analysis of fruit consumption with socio-demographic variables[1]. Results are reported only for those where there was a significant relationship. When significant differences in fruit consumption occur, significance levels, the chi-square and Cramer's V values are all displayed. Cramer's V provides an indication of the strength of the association; the closer to one, the stronger the association.

From these tables (Tables 6.1 - 6.4) it is clear that there were significant differences in fruit consumption associated with each of social class, location, age and smoker status.

Social class and its relationship with fruit consumption is shown in Table 6.1.

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[1] For the bivariate analysis, responses were recoded to meet the criteria for chi-square test (i.e. no cells with zero counts and no more than 20% of cells with less than 5 counts). The number of categories varied for each variable, but steps were taken to ensure the meaning was not lost (no recoding produced less than 3 categories, which had to clearly distinguish disagree, neither and agree).

Table 6.1 Chi-square statistic: Social class and fruit consumption - controlling for place, sex, smoker status and age

			Fruit consumption (%) Low	M-High	χ^2	Cramer's V
Social class n = 368		Non-manual	43.7	54.8	4.35*	0.108
		Manual	56.3	45.2		
Controlling for:						
1.Place	Bristol	Non-manual	39.0	47.8	n.s.	
		Manual	61.0	52.2		
	Glasgow	Non-manual	46.2	60.8	4.335*	0.139
		Manual	53.8	39.2		
2. Sex	Male	Non-manual	34.7	54.5	5.706*	0.193
		Manual	65.3	45.5		
	Female	Non-manual	50.8	54.9	n.s.	
		Manual	49.2	45.1		
3. Smoker status	Smoker	Non-manual	40.2	51.6	n.s.	
		Manual	59.8	48.4		
	Non-smoker	Non-manual	47.1	56.1	n.s.	
		Manual	52.9	43.9		
4. Age	<34	Non-manual	41.5	48.7	n.s.	
		Manual	58.5	51.3		
	35-54	Non-manual	47.9	76.5	11.09***	0.276
		Manual	52.1	23.5		
	>55	Non-manual	40.0	39.3	n.s.	
		Manual	60.0	60.7		

Note: * p<0.05, **p<0.001, ***p<0.001

Non-manual social class groups were more likely to consume fruit more than once a day than the manual group. However, when place, sex, age and smoker status effects were controlled for (i.e. the relationship between class and fruit consumption was examined for each sub-group), the social class effect only stood in specific circumstances. This suggests a spurious relationship between social class and fruit intake. In Glasgow, there was a difference between non-manual and manual social class groups (but not in Bristol), as there was amongst males and in the 35-54 age group. Within each control group, the non-manual group consumed more fruit than the manual group.

Table 6.2 shows the relationship between place and fruit consumption.

Table 6.2 Chi-square statistic: Place and fruit consumption - controlling for place, sex, smoker status and age

			Fruit consumption (%)		χ^2	*Cramer's V*
			Low	*M-High*		
Place		Bristol	35.2	47.8	6.17*	0.126
n = 390		Glasgow	64.8	52.2		
Controlling for:						
1. Sex	Male	Bristol	35.9	48.3	n.s.	
		Glasgow	64.1	51.7		
	Female	Bristol	34.6	47.4	n.s.	
		Glasgow	65.4	52.6		
2.Smoker status	Smoker	Bristol	41.7	42.9	n.s.	
		Glasgow	58.3	57.1		
	Non-smoker	Bristol	30.2	47.5	7.70*	0.178
		Glasgow	69.8	52.5		
3. Age	<34	Bristol	38.1	67.4	9.81**	0.277
		Glasgow	61.9	32.6		
	35-54	Bristol	29.0	35.2	n.s.	
		Glasgow	71.0	64.8		
	>55	Bristol	41.7	42.9	n.s.	
		Glasgow	58.3	57.1		
4. Social class	Non-manual	Bristol	30.9	40.0	n.s.	
		Glasgow	69.1	60.0		
	Manual	Bristol	37.6	53.0	4.198*	0.148
		Glasgow	62.4	47.0		

Note: * p<0.05, **p<0.001, ***p<0.001

While there appeared to be a difference in fruit consumption explained by location (a greater proportion in Glasgow exhibiting low fruit consumption), when controlling for socio-demographic variables, this was not consistent. There was no significant difference observed between Glasgow and Bristol, for the sex sub-groups. Within the manual social class group there was a significant difference in fruit consumption (those in Glasgow manual less likely to consume fruit than those in Bristol manual), but not within the non-manual social class groups.

Among the under 34 age group, of those who had medium-high consumption , 67.4% were in Bristol. There was no difference between smokers in Bristol and Glasgow, while non-smokers in Glasgow had lower fruit consumption than non-smokers in Bristol (69.8% of non-smoking low fruit consumers were in Glasgow).

The relationship between age and fruit consumption is explored in Table 6.3.

Table 6.3 ***Chi-square statistic: Age and fruit consumption - controlling for social class, place, sex and smoker status***

			Fruit consumption (%)		χ^2	*Cramer's V*
			Low	*M-High*		
Age n = 385		<34	36.2	28.1	11.88**	0.176
		35-54	43.1	35.3		
		>55	20.7	36.6		
Controlling for:						
1. Social class	Non-manual	<34	35.1	23.8	n.s.	
		35-54	46.4	48.8		
		>55	18.6	27.5		
	Manual	<34	38.7	30.3	18.824***	0.315
		35-54	39.5	18.2		
		>55	21.8	51.5		
2. Place	Bristol	<34	39.5	40.3	n.s.	
		35-54	35.8	26.4		
		>55	24.7	33.3		
	Glasgow	<34	34.4	17.3	14.578***	0.251
		35-54	47.0	43.2		
		>55	18.5	39.5		
3. Sex	Male	<34	37.9	22.0	15.185***	0.306
		35-54	44.7	32.2		
		>55	17.5	45.8		
	Female	<34	34.9	31.9	n.s.	
		35-54	41.9	37.2		
		>55	23.3	30.9		
4. Smoker status	Smoker	<34	32.0	32.4	n.s.	
		35-54	45.6	35.3		
		>55	22.3	32.4		
	Non-smoker	<34	39.2	27.1	10.321**	0.206
		35-54	41.6	35.6		
		>55	19.2	37.3		

Note: * p<0.05, **p<0.001, ***p<0.001

Considering the relationship between age and fruit consumption, it seems that those in the over 55 age groups were most likely to consume fruit, while those in the middle age group had lowest consumption. When controlling for sex, this was only the case for males, i.e. over 55 males were more likely to consume fruit than those under 55. There was a similar effect when considering place and social class sub-groups. Of those in Glasgow consuming fruit more than once per day, 39.5% were in the over 55 age group. The over 55s in the manual social class group consumed more fruit than those under 55 (but not for the non-manual social class group). For those who smoked, there was no difference between age groups. However, for non-smokers there was greater fruit consumption by the over 55s.

Smoker status was a very important variable in distinguishing between high and low fruit consumers, and is detailed in Table 6.4.

Table 6.4 Chi-square statistic: Smoker status and fruit consumption - controlling for place, sex, social class and age

			Fruit consumption (%) *Low*	*M-High*	χ^2	*Cramer's V*
Smoker status n = 382		Smoker	45.0	22.9	19.42***	0.226
		Non-smoker[1]	55.0	77.1		
Controlling for:						
1. Place	Bristol	Smoker	53.1	21.1	16.38***	0.328
		Non-smoker	46.9	78.9		
	Glasgow	Smoker	40.5	24.4	6.06*	0.162
		Non-smoker	59.5	75.6		
2. Sex	Male	Smoker	44.0	23.7	6.58*	0.203
		Non-smoker	56.0	76.3		
	Female	Smoker	45.7	21.5	13.84***	0.249
		Non-smoker	54.3	78.5		
3. Social class	Non-manual	Smoker	40.6	20.0	8.64**	0.221
		Non-smoker	59.4	80.0		
	Non-smoker	Smoker	47.5	23.1	10.66***	0.239
		Non-smoker	52.5	76.9		
4. Age	<34	Smoker	40.2	25.6	n.s.	
		Non-smoker	59.8	74.4		
	35-54	Smoker	47.5	22.2	9.40**	0.248
		Non-smoker	52.5	77.8		
	>55	Smoker	48.9	20.0	9.55**	0.306
		Non-smoker	51.1	80.0		

Note: * p<0.05, **p<0.001, ***p<0.001

Non-smokers were more likely to have higher consumption of fruit than smokers. When the sub-groups were examined, there were consistently significant differences between smokers and non-smokers, with non-smokers likely to eat more fruit. There was no significant difference between high and low consumers of fruit in terms of sex, housing type or presence of children.

In summary, from the bivariate analysis it appears that smoker status was the most important socio-demographic variable in explaining difference in fruit consumption, in terms of consistency, significance and strength of relationship (Cramer's V). Age was also important in explaining differences, although this effect (age) did not occur consistently across all demographic sub-groups. However, when it did, as in Glasgow, males and the manual social class group, age had a strong and significant effect. Place and social class seemed to have a more spurious influence on fruit intake than age, only occurring in very specific situations. Sex, housing type and presence of children appeared to have little or no influence on level of fruit consumption

6.2.2 Motivations, attitudes, beliefs and fruit consumption

The ordinal attitude, opinion and motivation variables were compared to see if there were any significant differences between low and medium-high fruit consumers in terms of these variables. The Mann-Whitney U test was the appropriate non-parametric test for two groups being compared on a variable which is ordinal. The null hypothesis was that there was no difference between the groups in terms of central location, focusing on the mean as a measure of central tendency (Diamontopoulos & Schlegelmilch, 1997). Table 6.5 reports those variables for which there was a significant difference between low and medium high consumers of fruit.

Table 6.5 *Mann-Whitney U test: attitude, opinion and beliefs variables by consumption*

Variable	Level	Fruit consumption (%) Low	Fruit consumption (%) M-High	Mann-Whitney U test statistics z	Mann-Whitney U test statistics 2-tailed p
Fruit fits eating habits	Disagree	9.4	3.8	-3.263	0.001
	Neither	26.6	17.2		
	Agree	63.9	79.0		
Improves appearance	Disagree	16.7	10.2	-4.121	0.000
	Neither	45.5	29.9		
	Agree	37.8	59.9		
Helps lose weight	Disagree	22.7	15.3	-2.369	0.018
	Neither	38.6	35.0		
	Agree	38.6	49.7		
Cheers me up	Disagree	21.0	14.6	-3.116	0.002
	Neither	43.3	33.1		
	Agree	35.6	52.2		
Variety of textures	Disagree	14.2	9.6	-2.54	0.011
	Neither	33.9	25.5		
	Agree	51.9	65.0		
Is comforting	Disagree	20.2	15.3	-2.22	0.028
	Neither	42.9	36.3		
	Agree	36.9	48.4		
Involves a lot of waste	Disagree	56.7	67.5	-2.168	0.030
	Neither	14.2	11.5		
	Agree	29.2	21.0		
Subjective norm	Disagree	8.2	5.7	-2.65	0.008
	Neither	27.0	16.6		
	Agree	64.8	77.7		
Protects against illness in later life	Disagree	5.2	3.8	-3.264	0.001
	Neither	32.6	17.8		
	Agree	62.2	78.3		
Behavioural intention	Disagree	8.2	5.7	-1.84	0.050
	Neither	34.8	28.0		
	Agree	57.1	66.2		

As well as the Mann-Whitney statistics, values are given for the percentage scoring along each category of the variables by level of consumption. The variables, which showed a significant difference between high and low consumption, appear to reflect the factor structure emerging from Section 5.4.3.3. Important variables, relating to 'medium term motivations', were 'fits in with eating habits', 'improves overall appearance' and, to a lesser extent, 'weight loss'. For each of these variables, higher consumers of fruit were more likely to agree with these statements, i.e.

fruit was believed to satisfy these motivations.

Other variables of importance related to 'hedonic motivations' and included 'variety of textures', 'fruit cheers me up' and 'fruit is comforting'. Again, it seems that those with a higher fruit consumption tend to perceive fruit as satisfying these motivations.

One significant variable related to 'product preparation' ('there is a lot of waste with fruit'), with lower fruit consumers agreeing with this more, although this variable was not as highly significant as the other variables. This level of significance, for the 'waste' variable, suggests this may not be that important a factor in distinguishing between high and low fruit consumption.

Significant differences in level of consumption in terms of 'longer term motivations' were represented by the variables 'protects me against illness', 'subjective norm' and to a lesser extent the 'behavioural intention' measure. Higher fruit consumers were more likely to agree with these statements.

This bivariate analysis revealed those variables which best explained differences in fruit consumption, and related mainly to factor variables concerning 'medium term motivations', 'hedonics' and 'long term motivations'.

6.2.3 Latent motivation, attitude and belief variables

The factor variables capturing the underlying structure of the attitude, opinion and beliefs variables (from Table 5.5) were saved as continuous (interval) variables. To compare the two groups of consumers in terms of these 'latent' variables the two-sample t-test was used, where the means of the two groups are compared. These results are shown in Table 6.6.

Table 6.6 ***Two sample t-test: factor variables by level of consumption***

	Mean		Std. dev.			
	Low	Medium -high	Low	Medium -high	t-value [2]	2-tail p
1. Medium term motivations	-0.117	0.173	0.970	1.022	-2.83	0.005
2. Product preparation	0.107	-0.159	0.986	1.003	2.60	0.010
3. Family influences	0.061	-0.091	0.936	1.084	1.48	n.s.
4. Suitability of fruit as a snack	-0.020	0.030	0.989	1.019	-0.48	n.s.
5. Quality	-0.063	0.093	1.010	0.981	-1.51	n.s.
6. Hedonic influences	-0.130	0.193	1.007	0.961	-3.16	0.002
7. Convenience	0.018	-0.271	0.986	1.022	0.44	n.s.
8. Longer term motivations	-0.158	0.234	0.994	0.965	-3.86	0.000

Of the latent variables, four showed significant differences between high and low consumers in terms of their motivations, attitudes and beliefs.

The factors measuring 'medium term motivations', 'hedonic influences' and 'longer term motivations' all show highly significant differences between the two groups. These particular latent variables were best at distinguishing between high and low consumers of fruit. The significance of these factor variables in distinguishing between high and low fruit consumers is not surprising, as these factor variables capture the variables which showed a significant difference between high and low consumers from Section 6.2.2.

There was a significant difference between the 2 groups in terms of 'product preparation', although at a weaker significance level. The weaker significance of 'product preparation' is not surprising, given that, in the earlier analysis of the motivation, attitude and belief variables (Section 6.2.2), only one of the variables loading on this factor showed a significant difference between high and low consumers.

The chi-square analysis of the socio-demographic variables indicated such variables were very important in influences on fruit consumption. The relationships between the latent factor variables and fruit consumption were further explored, controlling for socio-demographic variables, shown in Tables 6.7 - 6.10. All factor variables were recoded into ordinal variables, to examine their relationship with the categorical socio-demographic variables.

Table 6.7 Medium term motivations by fruit consumption, controlling for socio-demographic variables.

		Fruit consumption (%)		χ^2	*Cramer's V*
		Low	*M-High*		
Medium term motivation	very low	27.5	21.0	8.43*	0.147
	low	26.2	22.9		
	high	26.6	23.6		
	very high	19.7	32.5		
Controlling for:		Smoker	Yes	8.60*	0.249
			No	n.s.	
		Place	Bristol	n.s.	
			Glasgow	9.36*	0.200
		Social class	Non-man.	10.90*	0.248
			Manual	n.s.	
		Sex	Male	7.88*	0.219
			Female	9.24*	0.202
		Age	<34	n.s.	
			35-54	13.40**	0.295
			>55	n.s.	

Note: * p<0.05, **p<0.001, ***p<0.001

Medium-high consumers had a greater tendency to agree that 'medium term motivations' were important (56.1% high and 43.9% low). However, when each of the sub-groups were considered (i.e. statistical control for the socio-demographic variables), this relationship remained significant only in select sub-groups. This was the case for both sexes, for non-manual groups, for Glasgow, for the 35-54 age group and for smokers. This suggests that 'medium term motivations' were fairly consistent across the groups.

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[2] Although not reported here, the F values were considered to provided guidance as to which t-test statistics to read. If F is close to zero, then this means the two groups have similar variances (would be not significant). When this is the case, values for t and significance are taken from the 'Pooled variance estimate'. The greater the values the more dissimilar the two variances are (significant value for F given). Here, the test statistics are reported under 'separate variance estimate'. For these variables, all F-values were close to zero, i.e. variables had similar variances. Hence, all t-test statistics were read from 'pooled variance estimate'.

Table 6.8 ***Preparation by fruit consumption, controlling for socio-demographic variables***

		Fruit consumption (%) Low	*M-High*	χ^2	*Cramer's V*
Preparation	very low	18.9	33.8	13.12**	0.183
	low	24.9	25.5		
	high	27.5	21.7		
	very high	28.8	19.1		
Controlling for:		Smoker	Yes	11.38**	0.287
			No	n.s.	
		Place	Bristol	n.s.	
			Glasgow	10.20*	0.209
		Social class	Non-man.	12.43**	0.265
			Manual	n.s.	
		Sex	Male	n.s.	
			Female	20.69***	0.303
		Age	<34	11.938**	0.3066
			35-54	n.s.	
			>55	n.s.	

Note: * p<0.05, **p<0.001, ***p<0.001

Lower fruit consumers had greater agreement with the factor representing 'preparation', i.e. lower consumers associated greater difficulty with fruit consumption than the higher consumers. This effect was significant for Glasgow, for non-manual social class groups, for females, for those under 34 and for smokers.

Table 6.9 Hedonic motivations by fruit consumption, controlling for socio-demographic variables

		Fruit consumption (%)		χ^2	Cramer's V
		Low	*M-High*		
Hedonic motivations	very low	27.9	20.4	9.31*	0.154
	low	27.9	21.0		
	high	24.0	26.8		
	very high	20.2	31.8		
Controlling for:		Smoker	Yes	n.s.	
			No	11.07*	0.213
		Place	Bristol	n.s.	
			Glasgow	n.s.	
		Social class	Non-man.	n.s.	
			Manual	11.70**	0.247
		Sex	Male	n.s.	
			Female	8.61*	0.195
		Age	<34	n.s.	
			35-54	n.s.	
			>55	n.s.	

Note: * p<0.05, **p<0.001, ***p<0.001

High fruit consumers rated 'hedonic' influences as more important. However, when the sub-samples were considered, this was only consistently the case for a few specific groups, namely, for the manual social class groups, non-smokers and females.

Table 6.10 Long term motivations by fruit consumption, controlling for socio-demographic variables

		Fruit consumption (%)		χ^2	Cramer's V
		Low	M-High		
Long term motivations	very low	18.9	34.4	22.38***	0.239
	low	223	28.7		
	high	27.0	22.3		
	very high	31.8	14.6		
Controlling for:		Smoker	Yes	12.06**	0.295
			No	9.54*	0.199
		Place	Bristol	20.72***	0.363
			Glasgow	10.06*	0.207
		Social class	Non-man.	22.42***	0.356
			Manual	9.06*	0.218
		Sex	Male	8.77*	0.232
			Female	14.39**	0.252
		Age	<34	n.s.	
			35-54	n.s.	
			>55	9.52*	0.302

Note: * p<0.05, **p<0.001, ***p<0.001

'Long term motivations' appeared to be very significant at discriminating between high and low fruit consumers. Among the socio-demographic sub-groups, lower consumers rated higher on this scale (the negative direction of this factor means a high score is low agreement with statements) than high fruit consumers consistently across locations, social class, sex and smoker status. For age, the relationship was only evident among over 55s, and then was not very strong. This indicates that low consumers are less likely to be motivated by longer term issues, relating to health and behaviour, than high fruit consumers.

Of the composite motivation, attitude and belief variables, the most significant at discriminating between high and low fruit consumers related to 'long term motivations'. Those with higher fruit consumption tend to rate longer term motivations more highly than those who are low consumers. Bearing in mind this factor embodies the measures associated with the Theory of Planned Behaviour, this significance suggests that an analysis of fruit consumption in terms of these variables, in the context of the theory of planned behaviour, may be enlightening.

Also of importance were motivations relating to 'medium term motivations', a result anticipated from Section 6.2.2. When the socio-demographic sub-groups were considered, the influence of 'medium term motivations' still remained quite strong (e.g. for both sexes this motivation served as a good indicator of those who would be high and low consumers). Those with higher consumption tend to rate more highly along these variables.

Similar to the consistency exhibited by the factor variable measuring 'medium term motivations', was that factor for 'product preparation'. However, only one of the individual variables ('waste'), which loaded on this factor, displayed a significant difference in terms of high and low consumers. 'Product preparation' was considered not sufficiently significant, overall, for inclusion in the final model. The individual variables contributing to the factor variable 'hedonic motivations' appeared significant from Section 6.2.2. However, when high and low consumers were compared at the sub-group level, it appeared that 'hedonic motivations' was not as strong or as consistent at discriminating between high and low consumers.

For these reasons, only two factor variables ('longer term motivations' and 'medium term motivations') were included in the modelling analysis.

6.2.4 Marketing influences on fruit consumption

The marketing related variables, as detailed in section 5.6.2., were analysed in cross-tabulation with fruit consumption, with the exclusion of the two variables measuring 'perceived expense' and 'ease of availability'. Variables measuring 'expense' and 'availability' were not included, in this stage of the analysis, because each of these variables were encapsulated in the factor variable 'suitability of fruit as a snack', and were thus included in earlier analysis (section 6.2.2).

There were no significant differences between high and low consumers along any of the marketing variables. More detailed analysis, at the sub-group level, showed only one significant difference between high and low consumers. This difference was shown among the under 34s, where higher consumers were likely to purchase fruit at greengrocers ($\chi^2 = 6.063$, Cramer's V = 0.220, p = 0.048).

With no significant differences in level of consumption from the bivariate analysis with marketing variables, it seemed inappropriate to include these variables in multivariate analysis. Therefore, no marketing variables were included in the subsequent modelling of fruit consumption.

6.3 Correlations between significant variables influencing fruit consumption

To assess the level of association of each of the variables influencing fruit consumption, and to check for multicollinearity, it is useful to consider the correlation between influencing variables. The Spearman's rank correlation coefficient was used as a measure of association to examine the nature of the relationship (if any) between the significant variables influencing fruit consumption.

Table 6.11 shows there was no correlation between any of the socio-demographic variables, or with any other motivation, attitude or belief variable in their original, uncoded scales (not shown).

Table 6.11 ***Correlations between significant socio-demographic variables influencing fruit consumption.***

Variable	Age	Place	Class
Age	1.000		
Place	0.058	1.000	
Class	0.019	-0.081	1.000
Smoking	0.110	0.034	-0.082

All correlations are p>0.05

Clearly there are weak correlations between each of the socio-demographic variables, suggesting that their unique influence on fruit consumption is not due to the influence, of the other socio-demographic variables, impacting upon fruit consumption.

Earlier analysis has shown that there are a range of variables influencing fruit consumption. Table 6.12 presents correlations between each of the significant motivation, attitude and belief variables (in original form) and with the significant latent variables ('longer term motivations' and 'medium term motivations').

Table 6.12 Correlations between significant motivations, attitude and belief variables (original and factor) influencing fruit consumption.

Variable	Fits eating habits	Improves appearance	Helps lose weight	Subjective norm	Protects against ill health	Behaviour intention	Medium term motivations
Fits eating habits	1.000						
Improves appearance	0.465	1.000					
Helps lose weight	0.363	0.639	1.000				
Subjective norm	0.160	0.294	0.228	1.000			
Protects against ill health	0.256	0.286	0.232	0.451	1.000		
Behavioural intention	0.194	0.317	0.316	0.423	0.601	1.000	
'Medium term motivations	0.484	0.804	0.827	0.178	0.199	0.290	1.000
'Longer term motivations'	0.301	0.348	0.270	0.664	0.854	0.797	0.201

All correlations are significant at $p < 0.001$

Strong, positive correlations were observed between each of the variables measuring some aspect of medium term motivations and the latent variable 'medium term motivations' (as was expected). The variables 'fruit improves my appearance' and 'fruit helps me lose weight' correlated strongest with the factor variable 'medium term motivations', suggesting these were important variables contributing to this factor.

The strongest correlate with the factor variable 'longer term motivations' was 'protects against ill health', followed by 'behavioural intention', then 'subjective norm'.

Partial correlations supported these findings, although when the effect of the socio-demographic variables and factor variables (Tables 6.13 and 6.14 respectively) were partialled out, the correlation between the motivation, attitude and belief variables were considerably weakened.

Table 6.13 Partial correlations between motivations, attitudes and beliefs (significant original and factor variables) influencing fruit consumption, controlling for socio-demographic variables

Variable	Fits eating habits	Improves appearance	Helps lose weight	Subjective norm	Protects against ill health	Behaviour intention	Medium term motivations
Fits eating habits	1.000						
Improves appearance	0.427	1.000					
Helps lose weight	0.288	0.596	1.000				
Subjective norm	0.080	0.215	0.135	1.000			
Protects against ill health	0.228	0.203	0.146	0.426	1.000		
Behavioural intention	0.152	0.245	0.246	0.365	0.575	1.000	
'Medium term motivations	0.418	0.788	0.805	0.089	0.123	0.236	1.000
'Longer term motivations'	0.263	0.266	0.170	0.638	0.847	0.773	0.114

All correlations are significant at $p < 0.001$

Table 6.14 Partial correlations between attitude and beliefs (significant original) influencing fruit consumption, controlling for significant factor variables.

Variable	Fits eating habits	Improves appearance	Helps lose weight	Subjective norm	Protects against ill health
Fits eating habits	1.000				
Improves appearance	0.099	1.000			
Helps lose weight	-0.099	-0.150	1.000		
Subjective norm	-0.093	0.066	0.030	1.000	
Protects against ill health	-0.029	-0.111	-0.074	-0.303	1.000
Behavioural intention	-0.202	-0.834	-0.015	-0.258	-0.273

All correlations are significant at $p < 0.001$, except * $p<0.05$, ** $p<0.01$

This correlational analysis suggest that the socio-demographic variables do not significantly correlate with each other, nor with the motivations, attitudes and beliefs. Correlations between the factor variables and the motivations, attitudes and beliefs were as expected.

6.4 Intermediate summary

The bivariate analysis thus far conducted suggest that socio-demographic variables (especially social status and age) and factor variables ('longer term motivations' and 'medium term motivations') significantly influence fruit consumption. However, the nature of the interaction of these factors, influencing fruit consumption, is not clear from the bivariate analysis.

Attempts were made to examine the interactions by considering sub-groups only, thus controlling for the socio-demographic variables. This strategy, while useful for highlighting important variables, does not usually result in a systematic evaluation of the relationship between variables, as it does not allow for a simultaneous examination of pair-wise relationships. Perhaps more importantly, it is difficult to estimate the effects of the independent variables on the dependent variable, while controlling for the effect of the other variables.

To develop the model of the interaction between independent variables, a 2 stage approach was adopted. First non-parametric modelling of the significant variables was conducted. This produced a model of the inter-relationships in terms of probabilities and odds. While this was enlightening, it was not thought to be as accessible as the language and meanings associated with the parametric techniques, and for this reason parametric modelling took place. Discriminant analysis was the appropriate approach. This two stranded approach to the model was also believed to improve the validity of the final model presented.

6.5 Extent of variables' influence on fruit consumption: Log linear analysis

This section presents a model of the relationship between fruit consumption and the socio-demographic variables place, age, social class and smoker status. Sex, housing type and presence of children were omitted from the log linear modelling as earlier bivariate analysis indicated that there was no influence of sex, housing type or presence of children on fruit consumption.

The main aim of this modelling was to explore the socio-demographic variables which had an effect on fruit consumption, and to establish whether this was an independent or interactive effect. Loglinear modelling was used because of the categorical nature of the data (Agresti, 1996). The first stage in the analysis examined the model which best explained the underlying relationship between the socio-demographic variables. A logit model was then fitted, with fruit consumption as the dependent variable, categorised as low consumption (less than 7 times per week) and medium-high (7 or more times per week).

6.5.1 Assessing the fit of loglinear models of socio-demographic variables

This first analysis aimed to model the underlying structure of the socio-demographic variables only. Loglinear model building began by hypothesising relationships between the variables (Agresti, 1996). A forward selection approach was taken, where the starting point for model building was the simplest model and parameters were successively added until a model was derived with as few parameters as possible.

For this analysis P represents place, C represents social class, A represents age and S represents smoker status. Variables hypothesised by the model to be related are enclosed within curly brackets. Thus {PAC} is interpreted as a model where place, age and social class are related, while {S}{PAC}indicates a model where smoker status is not related to place, age and social class.

The simplest model, one where there was no interaction between the variables, is represented by {P}{A}{S}{C}. If an acceptable fit was provided by this model, no other tests would have been necessary. The fit of this model was tested against an alternative model where all the variables were allowed to interact, i.e. the saturated model {PACS}. Increasingly complex interaction terms were added, until an acceptable fit was obtained. The most acceptable model was one which could not be significantly improved by the addition of further terms. Use of the likelihood-ratio chi-square statistic (L^2) indicates the additional information conveyed by a variable or term. If the difference in L^2 relative to the difference in degrees of freedom is significant, it can be concluded that one or more independent variables (or their interactions) significantly affects the dependent variable. Table 6.15 describes the steps in the model building procedure.

Table 6.15 ***Hierarchical Loglinear Models relating to socio-demographic variables***

Model	Fitted Marginals	L^2	d.f.	p	ΔL^2	Δd.f.	p
1	{P A S C}	0	0				
2	{P} {A} {S} {C}	36.76	18	0.006	36.76	18	<0.005
3	{PA} {S} {C}	28.88	16	0.025	7.88	2	<0.025
4	{PS} {A} {C}	36.26	17	0.004	0.5	1	n.s.
5	{PC} {A} {S}	34.76	17	0.007	2	1	n.s.
6	{SA} {C} {P}	35.92	16	0.003	0.84	2	n.s.
7	{CA} {S} {P}	27.46	16	0.037	9.3	2	<0.010
8	{CS} {A} {P}	34.23	17	0.008	2.53	1	n.s.
9	**{PAC} {S}**	**11.43**	**11**	**0.408**	**a. 17.45**	**5**	**<0.005**
					b. 23.33	**6**	**<0.005**
					c. 16.03	**5**	**<0.010**
10	{ACS} {P}	27.46	16	0.037	a. 8.46	0	n.s.
					b. 0	0	n.s.
					c. 6.77	1	<0.010
11	{SPC} {A}	31.82	14	0.004	a. 4.44	3	n.s.
					b. 2.94	3	n.s.
					c. 2.41	3	n.s.
12	{APS} {C}	27.04	11	0.005	a.1.84	5	n.s.
					b. 9.22	6	n.s.
					c. 8.88	5	n.s.
13	{PAC} {PS}	11.432	11	0.408			
14	{PAC} {AS}	11.432	11	0.408			
15	{PAC} {CS}	11.432	11	0.408			

Key: P = place, A = age, C = class, S = smoker status, F = fruit

For this four variable table, the first comparison was between models 1 and 2. The change in L^2 was 36.76 at a change in degrees of freedom of 18 (highly significant at p = 0.006). Model 2 was therefore rejected and it was concluded that at least two or more socio-demographic variables were interacting. The next set of models (3 - 8) represent the systematic addition of single bivariate terms, representing the interaction of two socio-demographic variables, with the remaining socio-demographic variables included as independent terms. The addition of the socio-demographic variables showed a significant improvement in the fit of the model (i.e. the change in L^2 relative to Δd.f. for each addition is significant) only when smoker status (S) was added as an independent variable and age (A) was added in interaction. The addition of the term 'age and smoker status interaction' did not significantly improve the fit of the model. Of the models 3 - 8, none yielded an acceptable overall fit of the data.

Models 9 - 12 each included one three-way interaction term and one independent term. The level of improvement in fit of models was determined by comparison to the preceding models, which included the same independent terms present (i.e. model 9 was compared to models 3, 5 and 7). The addition of these trivariate terms indicated the improvement in fit with the addition of that variable, other than the remaining socio-demographic variables.

Model 9, including the three-way relationship between place, age and class, and the independent effect of smoking, provided a very good overall fit of the data ($p = 0.408$)[3]. Substantively, this model suggests that age, social class and place were all interrelated, after controlling for the effects of each other, while smoking was unrelated to any of these socio-demographic variables.

The log linear analysis provides the model which best explains the data in terms of the socio-demographic variables. While this process was important for the overall model building procedure, it provided no indication of the relationship between socio-demographic variables and fruit consumption (e.g. was fruit consumption independent of this interaction between the socio-demographic variables place, age and class?). The log linear model is the basis for the development of the logit model, where fruit is the dependent variable.

The hypothesis for the model best explaining the relationship between fruit consumption and the socio-demographic variables is one where the odds of fruit consumption depended on place, social class, age and smoking status (from initial bivariate analysis) and the interaction between place, age and social class (from the log linear model of socio-demographic variables). The hypothesised model best explaining the data was (FPAC)(FS), i.e. there was an independent effect of each of smoking, place, age and class on fruit consumption, and the interactive effect of place, age and class.

The logit model building began by considering the goodness-of-fit tests for several loglinear models. Models with independence, 2-factor terms, 3-factor terms and 4-factor terms were

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[3] A $p > 0.05$ suggests that the expected data generated by the proposed model would not be significantly different from the actual data, and the model is therefore a good fit to the data..

compared and are described in Table 6.16.

Table 6.16 ***Logit model for fruit consumption and the socio-demographic variables***

	Model	L^2	*d.f.*	*p*	*Improvement in fit of model (i.e. p value for associated Δ in L^2 and d.f.)*
1	Independence {F} {P} {A} {C} {S}	97.184	41	0.000	
2	{FP} {FA} {FS} {FC} {PA} {PS} {PC} {AS} {AC} {SC}	32.284	27	0.222	<0.005
3	{FPA} {FPC} {FPS} {FAS} {FAC} {FSC} {PAS} {PAC} {PSC} {ACS}	5.599	11	0.899	<0.05
4	{FPAC} {FPAS} {FASC} {PASC}	2.534	2	0.282	n.s.
5	{PAC} {FA} {FP} {FC} {FS} {AS} {CS} {PS}	49.052	29	0.011	n.s. (compared to 2)
6	{FPAC} {FS} {AS} {PS} {CS}	10.86	18	0.900	<0.025 (compared to 2)
7	{FPAC} {FAS} {FCS} {FPS} {ACS} {APS} {CPS}	5.849	9	0.790	n.s. (compared to 3)
8a	{FPAC} {AS} {PS} {CS}	30.698	19	0.044	<0.005 (compared to 6)
8b	{FPAC} {FS} {PS} {CS}	11.703	20	0.926	n.s. (")
8c	{FPAC} {AS} {FS} {PS}	11.674	19	0.899	n.s. (")
8d	{FPAC} {AS} {FS} {CS}	12.758	19	0.851	n.s. (")
9a	{FPAC} {FS} {PS}	12.41	21	0.928	n.s. (compared to 8b)
9b	{FPAC} {FS} {CS}	13.367	21	0.895	n.s. (")
9c	{FPAC} {FS} {AS}	13.789	20	0.841	n.s. (compared to 8d)
10	{FPAC} {FS}	14.299	22	0.891	n.s. (compared to 2)

Note: 1. Improvement in fit of the model is in comparison to the previous model.
2. Key: P = place, A = age, C = class, S = smoker status, F = fruit

The independence model fitted badly (1). The model with all two-factor terms included represented a vast improvement on Model 1, and was a fairly good fit to the data (p = 0.222). Model 3 (all three-factor terms) significantly improved the fit of the data (p = 0.899), and was a better fit than models 2 or 4. Model 4 (all 4-factor terms) was not a significant improvement on the previous model, but a fair fit (p = 0.282).

Model 3 provided the best fit to the data. However, earlier loglinear analysis of the socio-demographic variables implied a 3-way interactive effect for only place, age and class (not the socio-demographic variables in interaction with smoker status), signalling a more appropriate model of fruit consumption would have fewer 3-way interaction terms included than in model 3. Models were fitted which included this term (place, age and class in interaction) taking both models 2 and 3 as the starting point. Models 5, 6 and 7 show models using 2 and 3 as their basis.

The PAC term was included independent of F (model 5) and interacting with F (models 6 and 7).

The two best fitting models are 6 and 7 (2-way and 3-way interactions included respectively). While both appear to provide a good fit to the data, model 6 (based on model 2) is the better. This is because it represents a significant improvement in fit from model 2, the simpler model on which it is based. Model 7 (based on model 3) does not represent a significant improvement on model 3, even though it included the important FPAC term. This justifies proceeding with model 6 (model 2) as the guiding model.

To test for the most parsimonious representation, models were fitted where each of the two-way interaction terms (not included in term {FPAC}) were removed one at a time (models 8a - 8d). From these it was observed that removal of the term F-S (model 8a) resulted in a poor fitting model, while removal of the other two-factor terms had little effect on the overall fit (indicating a parsimonious model may be achieved by including F-S and with the removal of each of the other 2-factor terms).

Further testing, removing two-factor terms in combinations of two (except the F-S term) verified this (i.e. removal of these terms had little effect on the overall fit of the data). The final model, model 10, provided a very good, parsimonious fit of the data, the same as hypothesised. The final model is one where fruit consumption is dependent on the main effects of each of the socio-demographic variables (including smoker status) and dependent on the interaction effect of place, age and class best fitted the data set.

The equivalent logit model was fitted, using this log linear model as a starting point. The log linear model for {PFAC}{FS} is described as:

$$\ln(F_{ijklm}) = \mu + \lambda_i^{F} + \lambda_j^{P} + \lambda_k^{C} + \lambda_l^{A} + \lambda_m^{S} + \lambda_{ij}^{FP} + \lambda_{il}^{FA} + \lambda_{ik}^{FC} + \lambda_{jl}^{PA} + \lambda_{lk}^{AC} + \lambda_{jk}^{PC} + \lambda_{im}^{FS} + \lambda_{ijl}^{FPA} + \lambda_{ijk}^{FPC} + \lambda_{ilk}^{FAC} + \lambda_{jkl}^{PCA} + \lambda_{ijkl}^{FPAC}$$

The equivalent logit model has the additive form:

$$\text{logit}\,\pi = \alpha + \beta_j^{P} + \beta_l^{A} + \beta_k^{C} + \beta_m^{S} + \beta_{jl}^{PA} + \beta_{jk}^{PC} + \beta_{lk}^{AC} + \beta_{jkl}^{PAC}$$

Phi (Φ) is the log of the conditional odds of fruit consumption, and the βs (betas) correspond to the lambdas of the general loglinear model (e.g. $\beta^F = 2\lambda^F$). The model, above, describes the hypothesised situation where the odds of fruit consumption were dependent on place, class, age, smoker status (separately) and the interaction of place, class and age. The goodness-of-fit statistics for this model were $\chi^2 = 6.485$, d.f. = 11, p = 0.839, i.e. a very good fit to the data.

6.5.2 Interpretation of the logit parameters

Table 6.17 provides the parameter estimates for the logit model, essential to interpretation of the logit model.

Table 6.17 ***Estimates derived from the logit analysis {FPAC} {FS}***

Term	β^N_l	exp. β^N_l	Term	β^N_l	exp. β^N_l
$^{F}_{1}$	-1.43	0.24	$^{F}_{1}{}^{P}_{1}{}^{A}_{2}{}^{C}_{1}$	-0.245	0.783
$^{S}_{1}{}^{F}_{1}$	2.053	7.794	$^{F}_{1}{}^{P}_{1}{}^{A}_{2}{}^{C}_{2}$	0.245	1.278
$^{A}_{1}{}^{F}_{1}$	2.507	12.263	$^{F}_{1}{}^{P}_{1}{}^{A}_{3}{}^{C}_{1}$	1.411	4.100
$^{A}_{2}{}^{F}_{1}$	3.682	39.725	$^{F}_{1}{}^{P}_{1}{}^{A}_{3}{}^{C}_{2}$	-1.411	0.244
$^{A}_{3}{}^{F}_{1}$	-6.189	2.05×10^{-3}	$^{F}_{1}{}^{P}_{2}{}^{A}_{1}{}^{C}_{1}$	1.166	3.210
$^{P}_{1}{}^{F}_{1}$	-0.329	0.719	$^{F}_{1}{}^{P}_{2}{}^{A}_{1}{}^{C}_{2}$	-1.166	0.316
$^{C}_{1}{}^{F}_{1}$	-0.023	0.977	$^{F}_{1}{}^{P}_{2}{}^{A}_{2}{}^{C}_{1}$	0.245	1.278
$^{F}_{1}{}^{A}_{1}{}^{C}_{1}$	0.277	1.319	$^{F}_{1}{}^{P}_{2}{}^{A}_{2}{}^{C}_{2}$	-0.245	0.783
$^{F}_{1}{}^{A}_{2}{}^{C}_{1}$	-2.989	0.050	$^{F}_{1}{}^{P}_{2}{}^{A}_{3}{}^{C}_{1}$	-1.411	0.244
$^{F}_{1}{}^{A}_{3}{}^{C}_{1}$	0.220	1.245	$^{F}_{1}{}^{P}_{2}{}^{A}_{3}{}^{C}_{2}$	1.411	4.100
$^{F}_{2}{}^{A}_{1}{}^{C}_{1}$	-0.277	0.758	$^{F}_{2}{}^{P}_{1}{}^{A}_{1}{}^{C}_{1}$	1.166	3.210
$^{F}_{2}{}^{A}_{2}{}^{C}_{1}$	2.989	19.865	$^{F}_{2}{}^{P}_{1}{}^{A}_{1}{}^{C}_{2}$	-1.166	0.316
$^{F}_{2}{}^{A}_{3}{}^{C}_{1}$	-0.219	0.803	$^{F}_{2}{}^{P}_{1}{}^{A}_{2}{}^{C}_{1}$	0.245	1.277
$^{F}_{1}{}^{P}_{1}{}^{A}_{1}$	-1.910	0.145	$^{F}_{2}{}^{P}_{1}{}^{A}_{2}{}^{C}_{2}$	-0.245	0.783
$^{F}_{1}{}^{P}_{1}{}^{A}_{2}$	-0.852	0.426	$^{F}_{2}{}^{P}_{1}{}^{A}_{3}{}^{C}_{1}$	-1.411	0.244
$^{F}_{1}{}^{P}_{1}{}^{A}_{3}$	2.762	15.83	$^{F}_{2}{}^{P}_{1}{}^{A}_{3}{}^{C}_{2}$	1.411	4.100
$^{F}_{2}{}^{P}_{1}{}^{A}_{1}$	1.910	6.753	$^{F}_{2}{}^{P}_{2}{}^{A}_{1}{}^{C}_{1}$	-1.166	0.316
$^{F}_{2}{}^{P}_{1}{}^{A}_{2}$	0.852	2.344	$^{F}_{2}{}^{P}_{2}{}^{A}_{1}{}^{C}_{2}$	1.166	3.210
$^{F}_{2}{}^{P}_{1}{}^{A}_{3}$	-2.762	0.063	$^{F}_{2}{}^{P}_{2}{}^{A}_{2}{}^{C}_{1}$	-0.245	0.783
$^{F}_{1}{}^{P}_{1}{}^{C}_{1}$	0.445	1.560	$^{F}_{2}{}^{P}_{2}{}^{A}_{2}{}^{C}_{2}$	0.245	1.277
$^{F}_{1}{}^{P}_{1}{}^{A}_{1}{}^{C}_{1}$	-1.166	0.316	$^{F}_{2}{}^{P}_{2}{}^{A}_{3}{}^{C}_{1}$	1.411	4.100
$^{F}_{1}{}^{P}_{1}{}^{A}_{1}{}^{C}_{2}$	1.166	3.210	$^{F}_{2}{}^{P}_{2}{}^{A}_{3}{}^{C}_{2}$	-1.411	0.244

Key: P = place, A = age, C = class, S = smoker status, F = fruit

The lambdas (λ^N_l) represent the parameter 'effects' of the variables (main or interactive) (Ishii-

Kuntz, 1994: 6), and are provided as SPSS output. More useful to logit interpretation was the beta value (β^{N}_{l}), calculated by multiplying the equivalent lambda by two, which is shown in Table 6.17. Beta represents the arithmetic average of logits for the dependent variable across all levels of the particular independent variable, or interaction denoted by the superscript (Knoke & Burke, 1980:26). The exponential of this value (exp. β^{N}_{l}) further aids interpretation, giving values interpretable as the predicted odds (Norusis, 1993: 178). Table 6.17 displays the beta parameters and their exponential transformations for main and interactive effects, which assists in interpretation of the model.

The beta parameters in the logit model can be interpreted similarly to the additive coefficients of ordinary regression. The higher the absolute value, the greater the impact the independent variable or interaction terms has on the odds of the dependent measure occurring, with positive values raising the odds and negative values lowering the odds of the dependent variable occurring.

From Table 6.17 these beta values can be interpreted, with the values interpreted as their effect on low consumption as opposed to medium-high consumption. Exponential transformations (resulting in the multiplicative model) provide parameters which lend themselves to more straightforward interpretation, as they are presented in the 'odds' form. The exponential of β values can be interpreted as the relative odds of being in one category of the dependent variable versus the other.

Being a smoker substantially increased probability of being a low fruit consumer ($\beta = 2.053$). The exponential transformation shows smokers were 7.79 times more likely to be low fruit consumers than non-smokers. The probability of being a low fruit consumer also varied with age. Being under 55 increased probability of being a low fruit consumer quite substantially (the <34s were 12.26 times more likely and the 35-54s were 39.72 times more likely to be low fruit consumers), while being over 55 increased probability of being a medium-high consumer. Those in Bristol were less likely to be low fruit consumers than those in Glasgow (0.719 times), while those in the non-manual social class were only slightly less likely to be low fruit consumers than those in the manual class (0.977 times).

More interesting, to the current project, was the impact of the interaction of these variables on likelihood of low fruit consumption. This was assessed using the βs from above; a systematic approach is to insert the β values into the logit equation that represents the model, i.e.

$$\text{logit}\,\pi = \alpha + \beta_j^{P} + \beta_l^{A} + \beta_k^{C} + \beta_m^{S} + \beta_{jl}^{PA} + \beta_{jk}^{PC} + \beta_{lk}^{AC} + \beta_{jkl}^{PAC}$$

The probability of low fruit consumption (or medium-high) was calculated for each combination of socio-demographic variables, or set of conditions, and compared to establish how varying levels of the independent variables, in interaction, influence fruit consumption. Table 6.18 shows the probability of low fruit consumption (as opposed to medium-high) for each set of conditions, based on the logit model.

Table 6.18 **Probability of low fruit consumption based on the logit model {FPAC} {FS}**

	Place	*Social class*	*Age*	*Smoker*	*Model*	*logit* π[4]	*Expected odds* (e^{Φ})
1	Bristol	Non-man.	<34	Yes	$F_1P_1C_1A_1S_1$	0.441	1.554
2	Glasgow	Non-man.	<34	Yes	$F_1P_2C_1A_1S_1$	6.364	580.56
3	Bristol	Manual	<34	Yes	$F_1P_1C_2A_1S_1$	1.378	3.966
4	Glasgow	Manual	<34	Yes	$F_1P_2C_2A_1S_1$	4.414	82.6
5	Bristol	Non-man.	35 - 54	Yes	$F_1P_1C_1A_2S_1$	0.332	1.394
6	Glasgow	Non-man.	35 - 54	Yes	$F_1P_2C_1A_2S_1$	2.303	10.00
7	Bristol	Manual	35 - 54	Yes	$F_1P_1C_2A_2S_1$	5.956	386.06
8	Glasgow	Manual	35 - 54	Yes	$F_1P_2C_2A_2S_1$	8.697	5984.9
9	Bristol	Non-man.	>55	Yes	$F_1P_1C_1A_3S_1$	-1.06	0.346
10	Glasgow	Non-man.	>55	Yes	$F_1P_2C_1A_3S_1$	-9.638	6.52×10^{-5}
11	Bristol	Manual	>55	Yes	$F_1P_1C_2A_3S_1$	-5.166	5.71×10^{-3}
12	Glasgow	Manual	>55	Yes	$F_1P_2C_2A_3S_1$	-6.986	9.25×10^{-4}
13	Bristol	Non-man.	<34	No	$F_1P_1C_1A_1S_2$	-3.662	0.026
14	Glasgow	Non-man.	<34	No	$F_1P_2C_1A_1S_2$	2.281	9.786
15	Bristol	Manual	<34	No	$F_1P_1C_2A_1S_2$	-2.751	0.064
16	Glasgow	Manual	<34	No	$F_1P_2C_2A_1S_2$	0.308	1.361
17	Bristol	Non-man.	35 - 54	No	$F_1P_1C_1A_2S_2$	-3.751	0.023
18	Glasgow	Non-man.	35 - 54	No	$F_1P_2C_1A_2S_2$	-1.797	0.166
19	Bristol	Manual	35 - 54	No	$F_1P_1C_2A_2S_2$	1.85	6.36
20	Glasgow	Manual	35 - 54	No	$F_1P_2C_2A_2S_2$	4.591	141.3
21	Bristol	Non-man.	>55	No	$F_1P_1C_1A_3S_2$	-5.166	5.71×10^{-3}
22	Glasgow	Non-man.	>55	No	$F_1P_2C_1A_3S_2$	-13.744	1.07×10^{-6}
23	Bristol	Manual	>55	No	$F_1P_1C_2A_3S_2$	-9.272	9.40×10^{-5}
24	Glasgow	Manual	>55	No	$F_1P_2C_2A_3S_2$	-11.095	1.52×10^{-5}

Key: P = place, A = age, C = class, S = smoker status, F= fruit

[4] log of the expected odds of low fruit consumption, given these conditions

These results represent the impact on fruit consumption based on the *interaction* of the socio-demographic variables. The interactive aspect is very important because the main effects, reported above, suggest that only age and smoker status had, in the main, significant impact on the probability of low fruit consumption. While place and class did not appear to have a great main effect on probability of low fruit consumption, when considered in combination with other variables, their impact alters quite substantially.

The change in condition from Bristol to Glasgow, in interaction with the other variables, had a remarkable impact on the expected odds of low fruit consumption. This massive increase in expected odds was consistent at the various levels of the other variables in combination (excluding those where the over 55 age group was included). This logit model suggests that the move from Bristol to Glasgow, in combination with various levels of the other variables, drastically increases one's chances of being a low fruit consumer.

This is a significant result, since the main effects analysis suggested that the effect of place in isolation was not very substantial. However, in combination with the other variables, it has a profound effect on the expected odds of low consumption.

The effect of social class was also clearer from this analysis. While main effects, for social class, were not very substantial, in interaction with other variables, there was clearer evidence that being in the manual social class consistently contributed to increased odds of being a low fruit consumer. Like place, this social class effect was not so clear for the over 55 age group.

The interactive effect of smoker status was as expected; those who smoked had greater expected odds of low fruit consumption, consistent across all levels of the other socio-demographic variables.

There was no discernible pattern to the effects of age in interaction. Those under 34 and aged 35-54 had broadly similar patterns, with increases in expected odds more likely to be attributable to the interactive effects with the other variables. The over 55 condition consistently had very low expected odds (very close to zero) of low fruit consumption, in all combinations of variables, implying a category of variable which had little or no impact on the logit model. This lack of pattern could be attributed to there being very little difference in consumption patterns amongst this age group, with consumption levels stable, and hardly influenced by the other variables.

In conclusion, a logit model was derived which best explained the relationships between fruit consumption and the socio-demographic variables. This model was used to produce a set of expected odds for low fruit consumption, given varying levels of the socio-demographic variables.

Examination of these odds shows that the main effects of smoker status and age had an impact on fruit consumption; smokers had increased odds of low fruit consumption, while those in lower age groups (<55) had increased odds of low fruit consumption.

When considered in interaction with other socio-demographics (which is a more realistic picture of variables influencing fruit consumption), place and class both contributed largely to increasing the odds of low fruit consumption. Residents in Glasgow were more likely to have low fruit consumption than those in Bristol, with a similar effect evident for manual social class group as opposed to non-manual social class group.

To build a model which exploited the non-parametric approach, but enabled incorporation of the continuous variables measuring the latent factors, a logistic regression analysis was conducted, the next stage of model building.

6.6 Relative importance of the factors influencing fruit consumption: Logistic regression

A logistic regression model of socio-demographic variables, fruit consumption and the factors variables was developed, to model the influence of the socio-demographic variables and the (significant) motivation, attitude and belief factor variables on fruit consumption. Hence, a model was derived which included the psychological measures.

From section 6.2.3, two factor variables were found to be significantly related to fruit consumption. These were 'medium term motivations' (F1) and 'longer term motivations' (F8).

For this section of the analysis, fruit consumption was considered as the binary response 1(low consumption) or 0 (not low, i.e. medium high)[5]. The socio-demographic variables were included as dummy variables, coded using the deviation approach. This coding scheme allowed consideration of the effect of being in one category of a variable as compared to the average of the effects of the other variables (Norusis, 1993). With age measured over 3 categories, this was a very useful interpretative aid.

6.6.1 Model selection

The forward selection procedure was employed in a very similar way to that procedure for the log linear analysis, i.e. the simplest model was used as the starting point, with other terms successively added. While conceptually a forward selection procedure was employed, the function of the SPSS program ('forward selection') was not used; rather, each model was specified by the researcher, and entered as such.

The problem of multi-collinearity, potentially arising when there are several predictors, had to be considered. Returning to the correlation of variables (Section 6.2) the socio-demographic variables were all unrelated. Table 6.12 showed 'medium term motivations' and 'longer term motivations' to be significantly correlated. However the correlation between them was 0.201 (not very strong) indicating both variables should be included in the analysis, since neither was a good enough predictor of the other variable.

This model had 6 independent variables. The base model, against which subsequent models were compared, was the model where each of the independent variables had a main effect only on the dependent variable only. Since the earlier analysis suggested this was not the case for fruit consumption, the second model estimated was the simple model {PAC}{S}{F1}{F8}, i.e. the model where place, age and class were interacting and smoker status, 'medium term motivations'

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[5] This is not strictly correct use of binary; normally it would be used for 1 = consumption, 0 = no consumption. However, this adaptation has been used elsewhere (Agresti, 1996:119). The discriminant analysis (section 6.5) models the data set, with similarly presented variable formats. This overcomes the problem.

(F1) and 'longer term motivations' (F8) were considered as main effects only. Consecutive bivariate terms (parameters) were added until the model best fitting the data was achieved. At each level of model development, the previously entered model was used as a point of comparison.

Generally, the most useful indicator, of how well the logistic regression model fits the data, is the model chi-square value (known as Gm). This is a test of the null hypothesis that each of the beta values equal zero, i.e. the independent variables make no contribution to the model. When the Gm value is significant (i.e. $p<0.05$) then the null hypothesis is rejected and the model is a good fit. Another indicator of model fit is given by the level of correct classification.

The logistic regression model building is shown in Table 6.19.

Table 6.19 ***Results of fitting several logistic regression models to fruit consumption***

Model	Independent variables (model)	-2 Log likelihood (DM)	Gm [6]	d.f.	p	Correct classification
1	P+A+C+ S + F1 + F8[7]	420.624	66.789	7	0.000	69.61
2	PAC + S + F1 + F8[8]	419.839	0.785	2	0.6753	69.61
3	PAC + F1S + F8	415.460	0.001	1	0.9691	70.72
4	**PAC + F8S + F1**	**415.462**	**4.377**	**1**	**0.036**	**70.72**
5	PAC + F1F8 + S	414.203	1.257	1	0.2623	71.55
6	PAC + F1F8S	413.786	0.418	1	0.5181	70.72

Key: P = place, A = age, C = class, S = smoker status, F1 = medium term motivations, F8 = longer term motivations

The first model (base model for comparison) had a very high significance level, but the log linear analysis suggested that the socio-demographic variables were interrelated, not captured by this model. Table 6.19 shows Model 4 provided the best, overall, fit of the data. This model included the place, age and class interaction as well as the interaction of smoking with the latent variable relating to 'longer term motivations'. The latent variable for 'medium term motivations' was included as a main effect.

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[6] Model chi-square (the difference between -2LL when only the constant is included in the model and that for the current model). This is the most useful indicator of goodness-of-fit of the model.

[7] This model represents the main effects of each of the independent variables on fruit (dependent variable)

Table 6.20 shows the variables in the equation, with measures for the beta values, the exponential of the beta values, significance levels and the R values.

Table 6.20 ***Variables in equation***

Variable	Log odds (β)	Odds (exp. β)	sig.	R	Wald
Age 1	0.374	1.454	0.032	0.079	4.601
Age 2	0.2513	1.286	0.135	0.024	2.241
Class 1	-0.321	0.725	0.009	-0.105	6.654
Place 1	-0.389	0.678	0.002	-0.132	9.295
Smoker status 1	0.581	1.788	0.000	0.192	17.418
F1	-0.302	0.739	0.015	-0.096	5.880
F8	-0.596	0.550	0.000	-0.169	14.015
A(1) C(1) P(1)	0.118	1.125	0.499	0.000	0.456
A(2) C(1) P(1)	0.057	1.058	0.734	0.000	0.115
A(3) C(1) P(1)	-0.175	0.839	n.a.	n.a.	n.a.
F8 S(1)	-0.317	0.728	0.043	-0.070	4.063
Constant	0.548		0.001		15.090

Key: 1. P = place, A = age, C = class, S = smoker status, F1 = motivations towards medium term motivations, F8 = long term motivations
2. Base categories for comparison are Age 1 = <34, Class 1 = Non-manual, Place 1 = Bristol, Smoker 1 = Smoker

The exponential beta value provided increase in odds of low consumption as a result of increasing the value of the variable by 1 (i.e. change to next category for socio-demographic variables and increasing value for latent attitude and belief variables).

6.6.2 Interpretation of model

The logistic coefficient (β) was interpreted as the change in the log odds (for the dependent variable - which is low fruit consumption) associated with a one unit change in the independent variable. The individual effects are first considered.

The coefficient for smoking was 0.581. When smoker status changed from one to two (i.e. from smoker to non-smoker) and values for other independent variables remained the same, the log odds of being a low consumer was 0.581. Another approach to interpretation was to consider the odds (exp.β), with this change in smoker status leading to an odds of low fruit consumption of 1.788. Non-smokers were more likely (1.788 times) to have low fruit consumption.

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[8]This model included the interaction term of place, age and class (PAC), and the main effects of each of smoker status (S), motivations relating to medium term motivations (F1) and long term motivations (F8).

'Long term motivations' (F8) and 'medium term motivations' (F1) were similarly interpreted in terms of odds. As importance of 'long term motivations' increased, the odds of being a low fruit consumer changed by a factor of 0.550 (i.e. approximately half as likely). The same was found for attitudes relating to 'medium term motivations'. As 'medium term motivations' increased, the odds of being a low fruit consumer decreased by a factor of 0.739. The main effects for these attitudinal factors showed those who thought 'medium term motivations' and 'long term motivations' to be important had a greater probability of higher fruit consumption.

The interaction of age, class and place had a log odds of 0.118 for under 34s, 0.057 for 35-54 year olds and -0.3171 for over 55s. The log odds value (0.118) for under 34s was the change in log odds of low consumption as a result of increasing the value of place and class for the under 34 age group.

The effect of age in interaction with variables place and class over different levels can be interpreted as well as providing an understanding of the expected change in fruit consumption as a consequence of these socio-demographic variables. A change in place from Bristol to Glasgow (one to two) and in class from non-manual to manual (one to two) for under 34s lead to the odds of being a low fruit consumer changing by a factor of 1.125 (slightly increased). The same interaction conditions, but with age in the middle age group lead to a slight increase in the odds of being a low fruit consumer (odds of 1.058), and a decrease for the over 55 age group (0.728).

The interaction of smoker status and 'long term motivations' reduced the odds of being a low fruit consumer to a factor of 0.728, i.e. an increase in 'long term motivations' as well as being a non-smoker decreased the probability being a low fruit consumer.

This is a more likely situation than that suggested by consideration of the smoker main effects only - those who are motivated by their long term health prospects, and do not smoke, are more likely to eat fruit. This provides some insights into the strength of the influences. From the main effect, it became clear that those with a higher motivation for long-term health were less likely to be a low consumer (by odds of 0.739). The smoker main effect has been reversed through its interaction with this variable, suggesting it is a weaker influence in isolation, than that of 'longer term motivations'.

Consideration of the absolute values of the exponential beta values (exp. β) gave an indication of the relative impact of each of the independent variables in interaction. These effects suggested smoker status main effect had the most important influence on fruit consumption, followed by the interaction of place, age and class. The main effect of medium term motivations was next in terms of importance, followed by longer term motivations.

Although some confusing results were presented, overall they supported the findings from the earlier analyses. The information provided by the logistic regression was enlightening in providing both explanation and prediction of levels of fruit consumption behaviour. The logistic regression was also valuable in providing insights into the nature of the relationships amongst the independent variables.

All the analysis, thus far, has provided strong evidence as to the nature of the model of fruit consumption, with the emphasis being on the relationships between significant independent variables influencing fruit consumption. The last stage in the model building procedure is the development of the discriminant model of fruit consumption, to confirm the nature of the relationships. Taken together, these analyses result in a model of fruit consumption, which proposes magnitude and nature of relationships.

6.7 Relative importance of the factors influencing fruit consumption: discriminant analysis

The main aim of the discriminant analysis was to identify the dimensions along which groups were maximally different, and to predict group membership on the basis of the independent variables used to create the dimensions. Thus, it was a useful explanatory and prediction technique (Klecka, 1980).

6.7.1 Research design of the discriminant analysis

The main prerequisites of discriminant analysis are that two or more groups exist which differ on several variables and, because the technique requires that means, variances and covariances are computed, the variables are measured at interval level. For this analysis the grouping variable was fruit consumption, categorised into low and medium-high consumption

Predictor, or independent, variables for inclusion in the analysis were the most significant variables emerging from the earlier bivariate and multivariate (loglinear and logistic regression) analysis. The discriminant model developed included socio-demographic variables (recoded into dummy variables for inclusion in the analysis (Dant et al, 1990) in metric form as opposed to non-metric) as well as the significant factors emerging from the earlier analysis, in continuous form. Hence the independent variables were: age, smoker status, place, class, 'medium term motivations' and 'longer term motivations' (both in continuous form).

The sample of 374 met the suggested minimum size for application of discriminant analysis (Hair et al, 1995). In order to validate the model derived from the discriminant analysis, the sample was split with cases randomly assigned to analysis and holdout samples once only. Thus the discriminant function was developed with the analysis sample, and then applied to the holdout sample.

The analysis sample comprised a random 59.9% of total cases (224) and the holdout consisted of 40.1% (150). The recommended proportions are anything from 50:50 to 75:25, with 60:40 a favoured split (Hair et al, 1995).

The total sample provided a 62.33:1 ratio of observations to independent variables (374 observations for 6 potential independent variables). This ratio was 37.33:1 for the analysis sample, and 25:1 for the holdout sample, both greater than the minimum 20:1 ratio suggested (Hair et al, 1995).

Generally, inequality of group sizes poses no threat to the discriminant analysis (Hair et al, 1995). For the *total* sample, the two groups of consumers (low and medium-high) contain 224 and 150 observations respectively, making them comparable in size not to impact either the estimation or the classification processes (the proportion of 60:40 is used by Hair et al (1995) in his worked examples). For the analysis sample the breakdown was 115 low consumers and 109 med-high consumers, and 85 low and 65 medium-high consumers for the holdout sample.

6.7.2 Assumptions of discriminant analysis

The assumptions for discriminant analysis are normality of multivariate distributions, and equality of variance-covariance matrix. There were only two continuous variables included in this analysis ('medium term motivations' and 'longer term motivations' factor variables) and these both approximated to normality. All other variables included in the analysis were dummy coded variables, where normality was not of concern.

The null hypothesis would imply equality of variance-covariance. A common test of this is Box's M, where values over 0.05 are desirable. For this investigation, the significance of difference in the covariance matrices between the two groups was 0.0038 for the analysis sample and 0.1224 for the holdout sample. While this assumption (equality of variance-covariance matrix) was violated for the analysis sample, it was not for the holdout sample.

The sensitivity of the test to sample size and normality of the multivariate distributions, made this a less problematic situation (Hair et al, 1995).

6.7.3 Estimation of the discriminant function and assessing overall fit

The tables and findings were presented first for the analysis sample, and then, in summary form, for the holdout sample. A profile of group statistics enhanced the validation of the results, allowing examination of group differences. Table 6.21 shows the unweighted group means and standard deviations for each of the independent variables

Table 6.21 *Group descriptive statistics*

Group means	X[a]	1	2	3	4	5	6	7	Sample size
Low	1	0.346	0.412	0.476	0.345	0.429	-0.091	-0.183	115
Med_hi	2	0.316	0.346	0.207	0.406	0.545	0.120	0.268	109
Total		0.332	0.379	0.346	0.384	0.486	0.012	0.036	224

Std. dev.	X	1	2	3	4	5	6	7	Sample size
Low	1	0.478	0.494	0.502	0.483	0.497	0.939	0.981	115
Med_hi	2	0.467	0.478	0.407	0.493	0.500	1.098	0.815	109
Total		0.472	0.486	0.477	0.488	0.501	1.022	0.930	224

Key: X = Fruit consumption , 1 = Under 34 (age 1); 2 = 35-54 (age 2) ; 3 = Smoker status; 4 = place, 5 = social class, 6 = Medium term motivations; 7 = Long term motivations.
Note: The difference from the total sample is due to cases being omitted form analysis due to missing discriminating variables.

In Table 6.22, univariate F ratios are used to assess whether differences between means (the independent variables for the two groups) are significant.

Table 6.22 *Test for equality of group means between low and med_high consumers of fruit*

	Independent variables	Wilk's lambda	Univariate F ratio	Sig.
1	Age (1 = <34, 0 = over 35)	0.999	0.195	0.659
2	Age (1 = 35-54, 0 = under 34 and over 55)	0.996	0.981	0.339
3	Smoker status (1 = smoker, 0 = non-smoker)	0.920	17.838	0.000
4	Place	0.998	0.374	0.541
5	Social class	0.987	2.744	0.099
6	Medium term motivations	0.989	2.231	0.1368
7	Long term motivations	0.941	12.989	0.0004

Table 6.22 shows that there is a significant difference between group means for variables 'smoker status' and 'longer term motivations' suggesting these are very important variables in discriminating between high and low fruit consumption.

6.7.3.1 Estimation of the discriminant function

Since the objective was to determine which variables were the most efficient at discriminating between the two groups, a step-wise procedure was used. This procedure began with all the variables excluded from the model. One by one the variables were added until it was found that adding more variables did not improve discrimination. The values for Wilk's lambda and the univariate F ratios (Table 6.22) guided the stepwise discriminant procedure, indicating which variables were selected and at which step. Thus, smoker status was the first variable included in the procedure. Values for F-to-enter were displayed after each step, guiding the variable selection.

The approach for discrimination was Mahalanobis distances (D^2). This represented a measure of the 'distance' between the 2 populations. The stepwise procedure used the criterion of selecting the variables that maximised the minimum Mahalanobis distance between the group variables. The larger the D^2, the lower were the chances of allocating individuals to the wrong group. Thus a higher D^2 was desirable. The variables that were chosen were the ones which best improved the D^2 after each step. The percentage of individuals that were correctly allocated indicated how well the groups were separated using the variables in question.

For interpretative purposes the discriminant weights and loading for the function are reported. The independent variables were screened by the stepwise procedure and were significant enough to be included in the function.

Table 6.23 Discriminant function with standardised weights, discriminant loadings and ANOVA

	Standardised weights	*Structure matrix - Discriminant loadings*		*Univariate F ratio*	
Variable	Value	Value	Rank	Value	Rank
Age 1(1 = <34, 0 = over 35)	NI	0.045	7	0.195	7
Age 2 (1 = 35-54, 0 = under 34 and over 55)	-0.206	-0.158	5	0.981	5
Smoker status (1 = smoker, 0 = non-smoker)	-0.648	-0.698	1	17.838	1
Place	0.207	0.101	6	0.374	6
Social class	0.303	0.274	3	2.744	3
Medium term motivations	0.284	0.247	4	2.231	4
Long term motivations	0.573	0.596	2	12.989	2

Note: 1. Correct classification equalled 68.27%, and Box's M was 43.67 ($p = 0.003$).
2. Ranking is in terms of absolute value, i.e. irrespective of sign

The independent variables were ranked in terms of the weights (standard discriminant function coefficient) and loadings for the function (from structure matrix). These both indicated the discriminating power of the independent variables. The loadings were generally used in interpretation.

This discriminant function was highly significant, but had a canonical correlation value of only 0.3885. For this discriminant model, this gives an indication of variance explained by the model (Hair et al, 1995), interpreted as 15.1% (i.e. 0.3885^2) of the variance in the dependent variable was explained.

6.7.3.2 Assessing overall fit

The predictive accuracy of the discriminant function was assessed, through the classification matrices. Before determining (or considering) the classification matrix the 'cutting score' had to be determined. This cutting score was the score against which an individual's discriminant Z score was judged to determine into which group they should be classified. The dependent variable consisted of two groups: 115 low consumers (51.3% of sample) and 109 medium-high consumers (48.7%). The group centroids were -0.408 for low consumers and 0.432 for medium-high consumers. From these values, the procedure for classifying consumers was 'classify as *low* when discrimination score is *negative* and classify as *medium-high* when discrimination score is *positive*'.

Using this approach the classification matrix was devised. To test whether the prediction of the discriminant model was better than chance, Hair et al (1995) proposes the use of the proportional chance criteria (C_{pro}). This was calculated by $C_{pro} = p^2 + (1\text{-}p)^2$, where p = the proportion of individuals in group 1, and 1-p = the proportion of individuals in group 2. Thus the C_{pro} equalled 0.500, interpreted as 50% chance accuracy.

According to Hair et al (1995: 204) 'the classification accuracy should be at least 1/4 greater than that achieved by chance'. With a chance accuracy of 50%, the classification accuracy should be at least 62.5%. The classification accuracy for this example was 68.27% indicating a better than 'chance' prediction of group membership.

However this value only just fell within the acceptable margin. To further support this classification as better than 'chance', another statistic measure of classification accuracy relative to chance was applied. This was Press's Q where

$$\text{Press's Q} = \frac{[N - (n*k)]^2}{N\,(k-1)}$$

with N = total sample size, n = number of observations correctly classified and k = number of groups. For this example Press's Q equalled 27.77. This value was then compared to the chi-square value for 1 degree of freedom and the desired confidence level (6.63 for 1 d.f. and 0.01 confidence level). As Press's Q exceeded this critical value, it was deemed statistically significant, and prediction was concluded to be better than chance.

6.7.4 Interpretation of the discriminant function

The function was examined to determine the relative importance of each of the independent variables in discriminating between the groups (Table 6.23). This table gave an indication of the relative importance of each of the variables included in the model. Smoker status was the most important discriminating variable, with smokers more likely to have low consumption. 'Long term motivations' was also good at discriminating between high and low consumers; those who rated highly on these beliefs tended to fall into the medium-high category of consumption. Class was also good at discriminating, with manual social class more likely to be in the low consumption group. 'Medium term motivations' and place also discriminated, but to a lesser extent, with age a poor discriminator.

To investigate which consumption group an individual was likely to fall into, the standardised weights (the Standardised Canonical Discriminant Function) were used:

D (x) = -0.206 Age2 - 0.648 Smoker + 0.207 Place + 0.303 Social class + 0.284 'Medium term motivations' + 0.572 'Longer term motivations'.

Using the group means (group centroids), with low = -0.408 and med-high = 0.432, it was possible to determine group membership (low or medium-high) in terms of level of each of the independent variables. The discriminant function was therefore defined as follows: For function 1 to have a mean of -0.408 for group LOW, Age2 must be positive (i.e. 35- 54), smoker status must be positive (i.e. smoker), place must be negative (i.e. Glasgow), social class must be negative (i.e. manual), 'medium term motivations' must be low and 'long term motivations' must be low

Low fruit consumption was characterised by:

Variable	*Description*
Age	35-54
Smoker status	Smoker
Social class	Manual
Place	Glasgow
Medium term motivations (F1)	Low rating
Long term motivations (F8)	Low rating

The opposite characteristics would apply for medium-high consumption of fruit.

6.7.5 Validation of the discriminant results.

For validation analysis, the discriminant function was applied to the holdout sample, which came from the original sample, but was not used in the main analysis. Thus only internal validity could be estimated. The discriminant function was applied to the remaining sample, performing at an acceptable level in classifying the participants.

Correct classification was of a similar order to the analysis sample; 61.11% of cases were correctly classified. The C_{pro} value was slightly lower than that required (62.5%), but the Press's Q value for the holdout sample was 21.77, exceeding the critical value of 6.63 and making it an acceptable level of classification.

Overall, acceptable levels on measures of predictive accuracy were found in the holdout sample, implying good internal validity. External validity could be established through the use of additional samples. This was not conducted with this research, and represents a limitation in establishing the overall validity of the discriminant model.

6.8 Fruit model for those with a commitment to act

Drawing on the theoretical framework of goal directed behaviour, a model was developed of those with a commitment to act, operationalised in the current study as those with a positive behavioural intention. By considering the relative importance of influences on those motivated to consume more fruit, greater insights into the constraining and facilitating factors influencing fruit consumption were achieved.

The questionnaire included a measure of behavioural intention, 'I intend to eat more fruit/veg within the next year'. Level of agreement with this variable was measured along a 7 point Likert scale. Combining values 1-4 (i.e. strongly disagree to neither) included 39.2% of respondents, leaving the remainder (60.8%) as a sub-group with a positive behavioural intention towards eating fruit. Selecting those with positive behavioural intention only, a discriminant analysis was run again, whereby consumption level was taken as the discriminating variable. Thus a model was built of fruit consumption for those with a positive behavioural intention only.

All factor and socio-demographic variables were included, to see which contributed to the model. Deleting those which were not significant (to improve model fit) resulted in the discriminant model, detailed in Table 6.24.

Table 6.24 Discriminant model of fruit consumption, for those with commitment to act

	Std. weights	discriminant loading
Hedonic motivation	0.437 (3)	0.469 (1)
Place	0.572 (1)	0.432 (2)
Smoker status	-0.471 (2)	-0.389 (3)
Long term motivations	0.371 (5)	0.372 (4)
Age 1	-0.304 (6)	-0.371 (5)
Class	0.440 (4)	0.259 (6)
Medium term motivations	Not included (7)	0.079 (7)

This analysis was run for the whole sample (not with holdouts as the previous discriminant analysis were), due to sample size constraints. The model has a good fit with Box's M of 0.586, correct classification of 66.67% and explained 17% of the variance. Press's Q was 24.67, making this an acceptable level of classification The final model was:

D(x) = 0.437 Hedonics + 0.572 Place - 0.471 Smoker + 0.372 Longer term motivations – 0.304 Age1 + 0.440 Class.

In summary, when those who are committed to consumption of more fruit are considered, low consumption is characterised by:

Variable	*Description*
Hedonic (or immediate) motivation	Low
Place	Glasgow
Smoker status	Smoker
Age	<34
Long term motivations (F8)	Low rating
Social class	Manual
Medium term motivations (F1)	Low rating

Compared to the previous discriminant model, place has changed in its importance, as has hedonic motivations and social class.

Place became an important influence, with those with low consumption more likely to be from Glasgow. This is interesting as it very strongly indicates that place is a significant impediment to fruit consumption. Those with low consumption rated 'hedonic motivation' low; fruit did not satisfy hedonic motivations. Conversely, high consumers rated fruit higher as satisfying these motivations. Social class also was an important influence for those with a positive behavioural intention. Low consumption was characterised by the manual social class, suggesting that this is an important impediment to consumption.

From the factor analysis of motivation, attitude and belief variables (Section 5.4.3.3), 'long term motivation' was the factor along which the 'behavioural intention' item correlated. The discriminant analysis was run finally, omitting this factor variable, to investigate any changes in the structure of the discriminant model. The resulting discriminant model was:

D(x) = 0.498 Hedonics + 0.459 Place - 0.413 Smoker – 0.323Age1 + 0.276 Class - 0.119 Medium term motivations

This model had Box's M of 0.448, correct classification of 67.12% cases, Press's Q of 26.01

(acceptable) and explained 15.3% of the variance.

This omission of the factor variable perhaps logically makes more sense, but its exclusion also implicates the exclusion of such measures as subjective norm and long term health belief. For this reason, it seemed more appropriate to accept the model presented in Table 6.24, which included the 'long term motivation' variable.

6.9 Impediments to fruit consumption

The outcome of both the discriminant analyses was that the socio-demographic variables were very important influences on fruit consumption. From the discriminant model of fruit consumption overall, it appeared that smoker status was very important as an influence on consumption level, followed by longer term motivations. For those with a positive behavioural intention only, place became the most important influence, followed by hedonic motivations, social class and smoker status.

This is very interesting. The results from the second analysis suggests those factors which are impediments. While it may be the intention to eat fruit, if the hedonic motivations are not satisfied then this significantly constrains consumption. Class, smoker status and place were also significant factors leading to lower consumption. Those in Glasgow may intend to eat fruit, but by virtue of living in Glasgow are constrained. Likewise for the manual social class group. This suggests there are structural barriers to fruit consumption, although earlier analysis would suggest that the shopping variables did not influence consumption.

6.10 Summary of fruit consumption results

The main findings from each of the analyses are presented in Table 6.25. The table included the influencing variables and the strength and nature of each influence on fruit consumption.

Table 6.25 Summary of results of factors influencing fruit consumption

Analysis Section	*Influencing variable*	*Strength*	*Nature of influence on fruit consumption*
6.2 Bivariate	Smoker status	S	Smoking led to low fruit consumption
	Age	FS	<54 groups were low fruit consumers
	Place	W	Glasgow tended to have low consumption
	Social class	F	Manual led to low consumption
	'Long term motivations'	FS	Lower ratings for low consumers
	'Medium term motivations'	F	Lower ratings for low consumers
6.5 Loglinear model	Smoker status (main effect)	S	Smokers more likely to have low fruit consumption
	Age (main effect)	S	<55 more likely to have low fruit consumption.
	Place (interaction)	FS (varied)	Glasgow more likely to have low fruit consumption
	Social class (interaction)	FS (varied)	Manual social class more likely to have low fruit consumption
6.6 Logistic regression	Age, class and place (interaction)	W	All three interact, with Glasgow and manual consistently leading to lower consumption. The <55 had slightly higher odds of low consumption, while >55s had reduced odds of low consumption (i.e. higher consumption).
	Smoker status and 'long term motivations' interaction	F	An increase in ratings for 'long term motivations' and being a non-smoker, reduces likelihood of being a low fruit consumer.
	'Medium term motivations'	F	As ratings increase, the odds of being a low fruit consumer decrease
6.7 Discriminant analysis (total sample)	Smoker status	S	Smokers are lower consumers
	'Long term motivations'	S	Lower ratings for low consumers
	Class	F	Manual are lower consumers
	'Medium term motivations'	FW	Lower ratings for low consumers
	Age	FW	35-54 are lower consumers
	Place	FW	Glasgow are lower consumers
6.8 Discriminant analysis (those with positive behavioural intention)	'Hedonic motivations'	FS	Lower ratings for low consumers
	Place	S	Glasgow are lower consumers
	Smoker status	FS	Smokers are lower consumers
	Age	F	<34 low consumers
	'Long term motivations'	F	Lower ratings for low consumers
	Class	FS	Manual are lower consumers
	'Medium term motivations'	W	Lower ratings for low consumers

Key: For the *log linear model*, labels were assigned on the basis of beta values, where S = greater than 2.30 (strong), FS = 1.95 - 2.29 (fairly strong), F = 1.61-1.94 (fair), FW = 1.01 - 1.60 (fairly weak), and W = less than 1(weak). For the *bivariate*, strength was rated on the basis of significance level, and Cramer's V. For *discriminant and logistic regression analysis*, where a weighting was given, S = greater than 0.5 (strong), FS = 0.4 - 0.49 (fairly strong), F = 0.3 - 0.39 (fair), FW = 0.2 - 0.29 (fairly weak), and W = less than 0.19 (weak).

These analyses have shown that there are many variables acting to influence fruit consumption, with the precise nature of these influences very complex. Smoker status has a very strong effect on levels of fruit consumption. This is observed consistently as a main effect and, to a lesser extent, in interaction.

Those in the lower age groups tended towards lower fruit consumption. This was always the case for the under 34s, but in interaction (in the log linear analysis), the effect of varying age level over 35 was dependent in the levels of the other socio-demographic variables. While place and class had fairly weak main effects, when interacting with the other socio-demographic variables, their impact increased dramatically. Substantively, the inclusion of place, in interaction, consistently led to those in Glasgow having lower fruit consumption. A similar effect was evident with the inclusion of social class in interaction, where manual social class status led to greater likelihood of lower fruit consumption.

The factor variables, representing the influence of motivations, attitudes and beliefs, had an effect on fruit consumption. 'Long term motivation' in particular had a strong influence on fruit consumption; those who rated low on this factor were more likely to have lower consumption. This was also the case for motivations relating to 'medium term motivations' although not as consistently strong.

Smoker status in interaction with the psychological factor variable 'long term motivation' had a fairly strong effect: non-smokers who rated high on this variable had higher consumption (suggesting the influence of 'long term motivations' was strong). The opposite was the case for 'medium term motivations': non-smokers who rated high on this variable had a low consumption.

The discriminant analysis showed smoker status to be the most important influence on fruit consumption. 'Longer term motivations' were also a fairly strong influence, although this was not so great when only those with a positive behavioural intention were considered. In this situation, place and social class become very important influences, suggesting the effects of these factors conspires against increasing fruit consumption, even when that is the goal.

6.11 Spatial representation of fruit consumption model

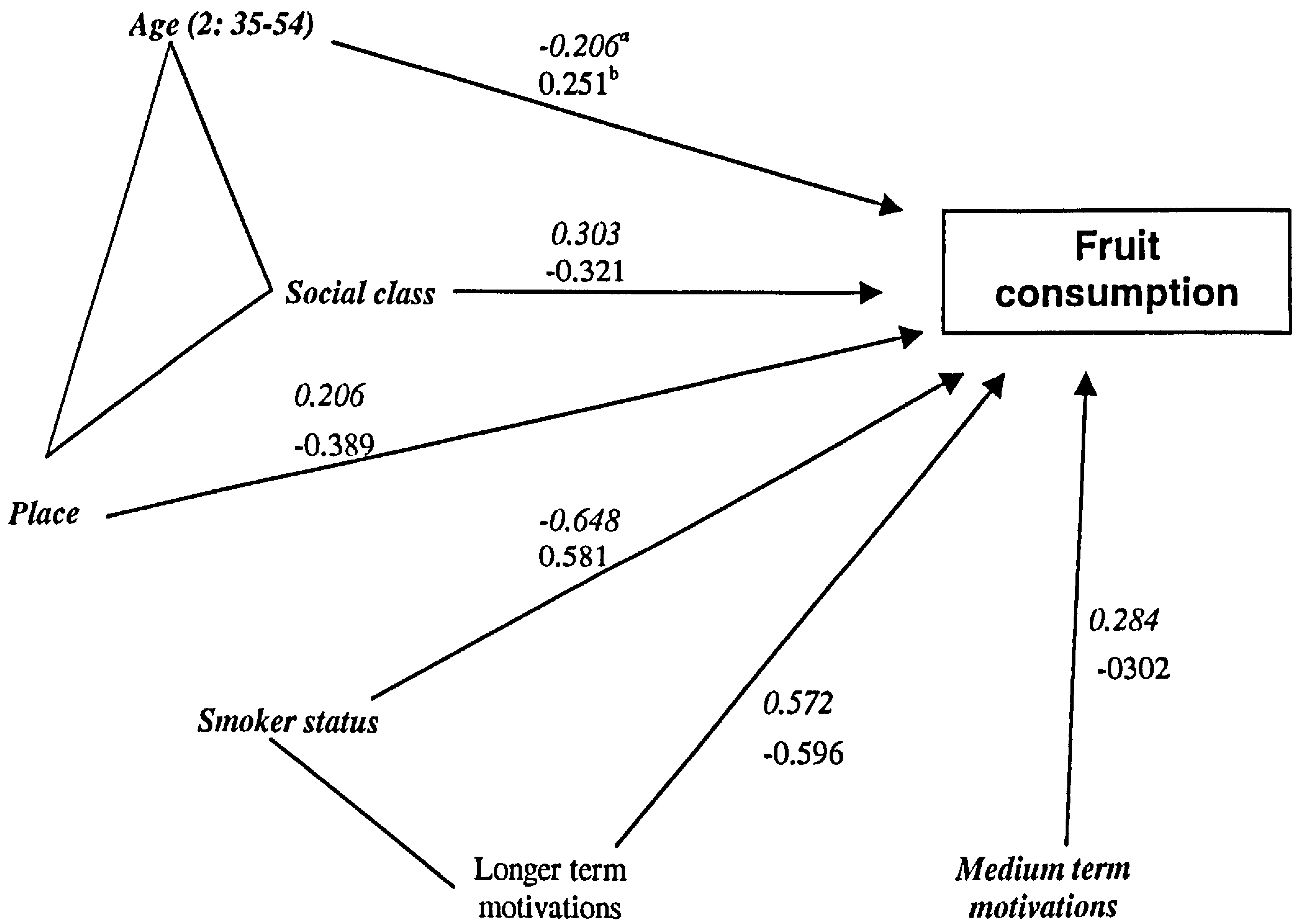
The final stage of this analysis is to present these results in relation to model, proposed in Chapters 2 and 4. This is shown in Figure 6.1.

This figure presents the spatial relationship between each of the predictor variables, as well as venturing to quantify the extent of the relationship, by reporting beta values. The structure and values are based on all the analysis provided above. The log linear analysis gave information with regard to the interactions amongst the socio-demographic variables. No beta values are provided as the values are only in relation to each other, not incorporating the effect of the interaction with the latent variables. However, the logistic regression, which used the loglinear results as a basis for model selection, does go further in establishing the contribution to the model of each of the main effects and the interaction effects. This, in combination with the discriminant analysis findings, forms the basis of the model reported. For the significant variables the discriminant weight is given first then the logistic regression weight.

Figure 6.1 shows that for fruit consumption the main influences are those acting at an individual level. Personal characteristics, especially smoker status, are very important influences on consumption. Of the psychological variables, it appears motivation is very important. In particular, the higher level motivation, 'longer term motivation' related to health, was an important influence.

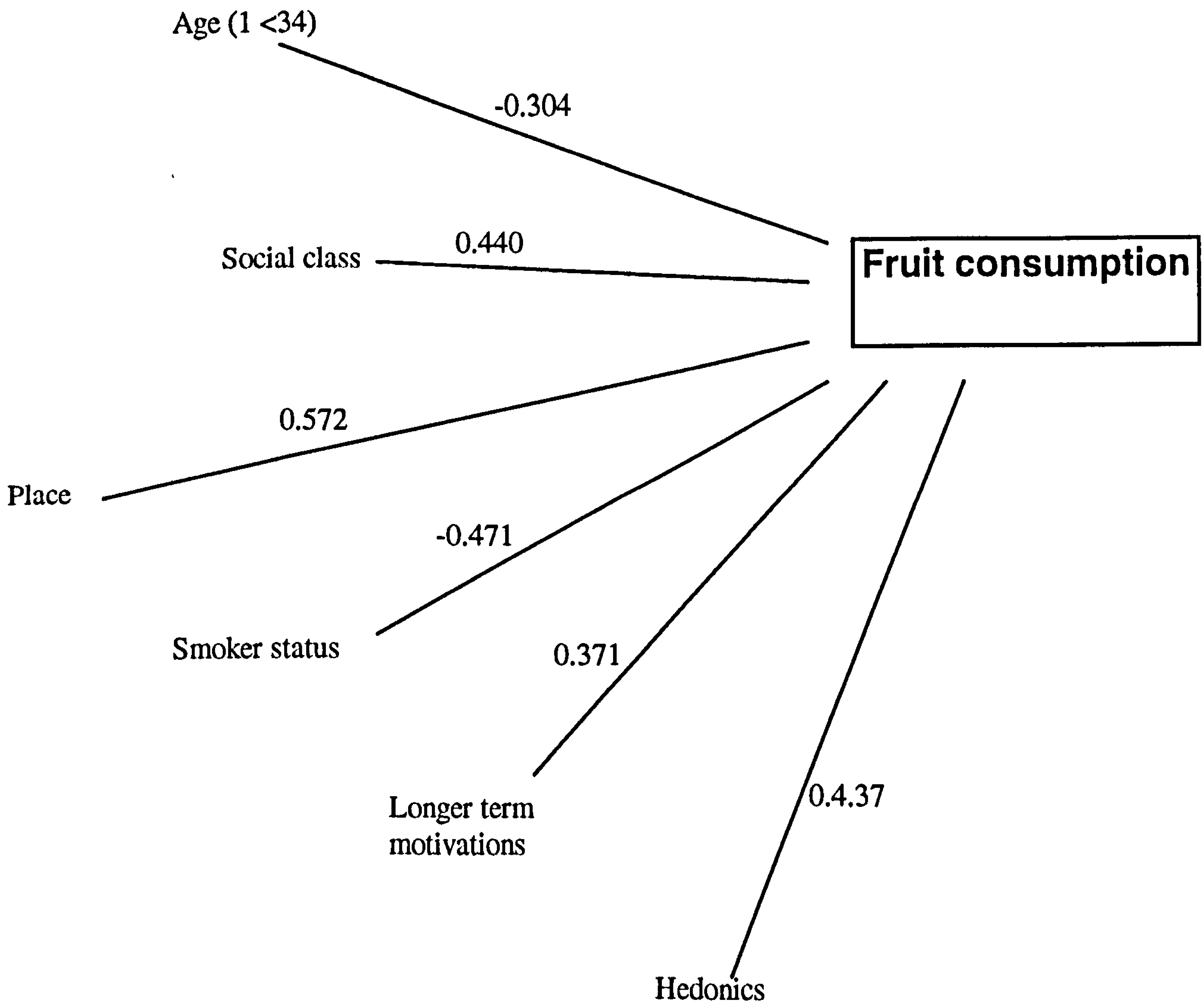
Figure 6.2 presents the discriminant model developed for those with a positive behavioural intention only. The model for those committed to consuming fruit shows the relative position, and importance, of variables had altered. The personal characteristics are still very important; place is the most important variable influencing consumption, followed by smoker status, and social class. Of the psychological variables, hedonics is the most important.

Figure 6.1 The final model of fruit consumption based on the total sample.[9]



[9] Key: *a: Discriminant weight,* b: Logistic regression weight

Figure 6.2 The final model of fruit consumption based on the those with a positive behavioural intention only[10]



[10] All weights are from discriminant analysis only

Chapter 7 Vegetable consumption model

7.1 Introduction

This chapter outlines the procedures leading to the development of a model of vegetable consumption. As for the model of fruit consumption, the modelling procedure follows the objectives outlined in chapter 5.

1. To establish the most salient variables influencing vegetable consumption.
2. To identify the extent to which each of these variables influences vegetable consumption
3. To compare the relative importance of the factors influencing vegetable consumption

7.2 Salient variables influencing vegetable consumption

This analysis follows the same structure as that for fruit analysis. Bivariate analysis is first conducted, followed by logit modelling. Logistic regression and discriminant models are finally developed. Log linear analysis is not repeated, since the log linear analysis was applied to model the structure underlying the socio-demographic variables, the same for vegetables as for fruit. As previously, in Section 5.4, the socio-demographic variables were categorical in nature, the attitude, opinion and belief variables were ordinal, the latent variables emerging from the principal components analysis of these variables were interval, and the dependent variable (vegetable consumption) had been grouped into two categories.

7.2.1 Socio-demographic variables

Bivariate analysis, in the form of chi-square analysis, was again performed to explore the relationships suggested from the initial descriptive analysis of vegetable consumption by demographic sub-group (section 5.6.6). Tables 7.1 and 7.2 present findings of the chi-square analysis, of vegetable consumption by socio-demographic variables. Results are reported only for those socio-demographic variables where there was a significant relationship (social class and age).

Table 7.1 shows the relationship between social class and vegetable consumption.

Table 7.1 Chi-square statistic: Social class and vegetable consumption - controlling for place, sex, smoker status and age

			Fruit consumption (%) Low	M-High	χ^2	Cramer's V
Social class		Non-manual	44.1	53.0	2.905	0.088
n = 368		Manual	55.9	47.0	(p = 0.08)	
Controlling for:						
1.Place	Bristol	Non-manual	43.8	42.2	n.s.	
		Manual	56.3	57.8		
	Glasgow	Non-manual	44.4	60.0	5.42*	0.155
		Manual	55.6	40.		
2. Sex	Male	Non-manual	37.5	47.7	n.s.	
		Manual	62.5	52.3		
	Female	Non-manual	49.1	56.6	n.s	
		Manual	50.9	43.4		
3. Smoker status	Smoker	Non-manual	39.2	48.1	n.s.	
		Manual	60.8	51.9		
	Non-smoker	Non-manual	48.0	55.5	n.s.	
		Manual	52.0	44.5		
4. Age	<34	Non-manual	45.5	40.9	n.s.	
		Manual	54.5	59.1		
	35-54	Non-manual	48.7	68.1	5.60*	0.197
		Manual	51.3	31.9		
	>55	Non-manual	36.0	43.1	n.s.	
		Manual	64.0	56.9		

Note: * p<0.05, **p<0.001, ***p<0.001

There was a slight significant difference between the social class groups in terms of their vegetable consumption (p = 0.08), but this was very weak. Those in the non-manual social class groups were more likely, than the manual groups, to eat vegetables more than once day. When examining this relationship at the sub-group level, this difference between non-manual and manual groups, in terms of vegetable consumption, was only the case in Glasgow and for the middle age group, suggesting a weak and spurious relationship between social class status and vegetable consumption.

The other socio-demographic variable, which had a significant relationship with vegetable consumption, was age and is shown in Table 7.2.

Table 7.2 ***Chi-square statistic: Age and vegetable consumption - controlling for social class, place, sex and smoker status***

			Fruit consumption (%) *Low*	*M-High*	χ^2	*Cramer's V*
Age n = 385		<34	38.0	26.6	5.57	0.120
		35-54	37.5	43.2	(p =	
		>55	24.5	30.2	0.061)	
Controlling for:						
1. Social class	Non-manual	<34	38.9	20.7	6.99*	0.199
		35-54	41.1	54.0		
		>55	20.0	25.3		
	Manual	<34	37.2	33.8	n.s.	
		35-54	34.5	28.6		
		>55	28.3	37.7		
2. Place	Bristol	<34	40.0	39.7	n.s.	
		35-54	30.6	324		
		>55	29.4	27.9		
	Glasgow	<34	36.6	17.8	10.35**	0.211
		35-54	42.0	50.5		
		>55	21.4	31.7		
3. Sex	Male	<34	34.7	28.4	n.s.	
		35-54	36.8	44.8		
		>55	28.4	26.9		
	Female	<34	40.5	25.5	6.42*	0.169
		35-54	38.0	42.2		
		>55	21.5	32.4		
4. Smoker status	Smoker	<34	37.0	25.0	n.s.	
		35-54	42.0	44.6		
		>55	21.0	30.4		
	Non-smoker	<34	38.5	27.4	n.s.	
		35-54	35.4	42.5		
		>55	26.2	30.1		

Note: * p<0.05, **p<0.001, ***p<0.001

Amongst medium-high vegetable consumers, the greatest proportion was in the older age groups, i.e. over 35. When the sub-groups were considered, this higher consumption, by this age group, was only among females, Glasgow and the non-manual social class group. Females over 35 were more likely to consume vegetables than females under 34 (no significant difference amongst males). Within the non-manual social class, those aged under 34 had low vegetable consumption, and the 35-54 age groups had the greatest proportion of medium-high consumption. There was not much difference in levels of consumption amongst the over 55s. Within Glasgow, this difference in levels of consumption was again apparent. For the under 34s there was a greater tendency towards low consumption, while the other two age groups were approximately evenly split in terms of low and medium-high consumers. There was no significant differences between high and low vegetable consumers in terms of place, smoker status, sex, housing type or presence of children.

In summary, this bivariate analysis suggests that, while some the socio-demographic variables do influence vegetable consumption, their effect is spurious, only occurring in very specific situations. Age appears to be the most important socio-demographic variable in explaining differences in vegetable consumption, but this effect did not occur consistently across socio-demographic sub-groups. Most importantly, the younger age group had a tendency towards lower vegetable consumption. The effect of social class status was similar to that of age; when there were differences observed between the social class groups in terms of their vegetable consumption, the manual group had lower consumption levels. While location and smoker status did not have any significant main effect on vegetable consumption, they did contribute to explaining differences between high and low consumers in certain circumstances (not shown in detail). Sex, housing type and presence of children appeared to have little or no influence on level of vegetable consumption.

7.2.2 Motivations, attitudes, beliefs and vegetable consumption

This analysis aimed to investigate differences between groups of consumers (as defined as high and low vegetable consumption) in terms of their level of agreement with each of the attitude, opinion and belief statements. The Mann-Whitney U test was used again, with the null hypothesis that there is no difference between the groups in terms of central location. Table 7.3 presents each of the motivation, attitude and belief variables, where there was a significant difference between high and low consumers, giving both the Mann-Whitney U test statistics and the percentage scoring along each category of the variable, by level of consumption.

Table 7.3 Mann-Whitney U test: attitude, opinion and belief variables by consumption

		Vegetable consumption (%)		Mann-Whitney U test statistics	
Variable	*Level*	*Low*	*M-High*	*z*	*2-tailed p*
Vegetables are not messy	Disagree	18.0	28.9	-3.218	0.001
	Neither	33.2	37.0		
	Agree	48.8	34.1		
Cheers me up	Disagree	25.8	13.3	-3.252	0.001
	Neither	46.5	47.4		
	Agree	27.6	39.3		
Interesting	Disagree	19.4	7.5	-4.238	0.000
	Neither	34.6	26.6		
	Agree	46.1	65.9		
Variety of textures	Disagree	13.8	4.6	-4.145	0.000
	Neither	32.7	22.5		
	Agree	53.5	72.8		
Variety of flavours	Disagree	7.4	1.7	-3.485	0.000
	Neither	24.9	15.6		
	Agree	67.7	82.7		
Is comforting	Disagree	24.4	15.0	-1.94	0.051
	Neither	40.6	43.9		
	Agree	35.0	41.0		
Subjective norm	Disagree	8.8	6.4	-2.92	0.003
	Neither	26.7	15.0		
	Agree	64.5	78.6		
Protects against illness in later life	Disagree	5.5	5.2	-2.53	0.011
	Neither	29.5	17.3		
	Agree	65.0	77.5		
Behavioural intention	Disagree	11.5	5.8	-2.29	0.022
	Neither	36.4	31.8		
	Agree	52.1	62.4		

The variables which showed a significant difference between high and low vegetables consumers can be considered as relating to 'convenience', 'hedonic motivations' and 'longer term motivations'.

Overall, those with higher consumption of vegetables had a greater tendency to disagree with 'vegetables are not messy to eat', while those with lower consumption agreed with the statement. These findings are unexpected; essentially the higher consumers think vegetables are messy, while lower consumers do not believe this to be the case. This construct, messiness of vegetables, is relates to the convenience aspect of vegetables.

Higher vegetable consumers had a greater tendency to agree with the statements 'vegetables cheer me up', 'vegetable are interesting', 'vegetables have a variety of textures', 'vegetables have a variety of flavours' and 'vegetables are comforting'. These five motivation, attitude and belief variables all relate to aspects of hedonic consumption, suggesting it may be an important factor in differentiating high from low vegetable consumers.

The subjective norm statement 'people who are important to me think eating vegetables is a good thing' gives significantly different ratings between high and low vegetable consumers, with higher consumers in greater agreement with the statement. In terms of health benefits (eating vegetables can protect me against illness in later life) associated with vegetable intake, there was a significant difference between high and low consumers, with higher vegetable consumers more likely to be motivated by longer term health benefits, than lower vegetable consumers. Higher vegetable consumers were also more likely to have positive behavioural intentions with regard to vegetables.

Those variables which best explained differences in vegetable consumption related mainly to motivations concerning aspects of hedonic consumption (i.e. related to experiential aspects of consumption and immediate consumption factors). In particular, perceptions of 'variety in texture', 'variety of flavours' and 'vegetables are interesting' were important in distinguishing high from low consumers. Other important hedonic statements were 'comforting' and 'cheers me up'. To a lesser extent subjective norm and longer term health beliefs, were important, as was perceived convenience of vegetables in discriminating between the levels of consumption.

7.2.3 Latent attitude, opinion and belief variables

The two groups of consumers (high and low) were examined in terms of the latent/factor variables using the two sample t-test statistic. Three factor variables showed significant differences between high and low consumers in terms of their motivations, attitudes and beliefs, and are shown in Table 7.4.

Table 7.4 ***Two sample t-test: factor variables by level of consumption***

	Mean		Std. dev.			
	Low	Medium-high	Low	Medium-high	t-value	2-tail p
1. Medium term motivations	-0.63	0.079	1.024	0.966	-1.40	n.s.
2. Product preparation	0.038	-0.048	0.938	1.073	0.84	n.s.
3. Quality	-0.059	0.075	1.08	0.88	-1.32	n.s.
4. Family influences	-0.032	0.040	1.033	0.959	-0.71	n.s.
5. Longer term motivations	-0.141	0.177	0.931	1.056	-3.16	**0.002**
6. Hedonic influences	-0.186	0.234	1.028	0.914	-4.21	**0.000**
7. Convenience	0.129	-0.162	0.966	1.020	2.89	**0.004**
8. Suitability of vegetables as a snack	-0.045	0.056	1.005	0.994	-1.00	n.s.

Motivations, attitudes and beliefs relating to 'long term motivations', 'hedonic influences' and 'convenience' showed significant differences in mean ratings for high and low vegetable consumers, i.e. these particular factor motivations, attitude and belief variables were best at distinguishing between high and low consumers of vegetables. The relationships between 'long term motivations' and vegetable consumption, and 'hedonic influences' and vegetable consumption were particularly significant.

Relationships between the significant factor variables and vegetable consumption were further explored, examining the relationships at a sub-group level, and are shown in Tables 7.5 - 7.7.

Table 7.5 Longer term motivations by vegetable consumption, controlling for socio-demographic variables

		Vegetable consumption %			
		Low	*M-High*	χ^2	*Cramer's V*
Longer term motivations	very low	31.3	17.3	16.71***	0.207
	low	25.8	23.7		
	high	24.9	25.4		
	very high	18.0	33.5		
Controlling for:		Smoker	Yes	14.17**	0.320
			No	n.s.	
		Place	Bristol	10.01**	0.251
			Glasgow	9.09*	0.197
		Social class	Non-man.	n.s.	
			Manual	13.14**	0.262
		Sex	Male	n.s.	
			Female	10.09**	0.212
		Age	<34	12.35**	0.311
			35-54	n.s.	
			>55	n.s.	

Note: * p<0.05, **p<0.001, ***p<0.001

Those with a higher consumption of vegetable had a greater tendency to agree that 'longer term motivations' were important. Analysis of sub-groups showed this relationship remained significant across both locations, for smokers, those in the manual social class group, for females and the under 34 age group.

Table 7.6 ***Hedonic influences by vegetable consumption, controlling for socio-demographic variables***

		Vegetable consumption (%) Low	M-High	χ^2	Cramer's V
Hedonic influences	very low	34.1	13.3	25.54***	0.255
	low	22.1	19.7		
	high	24.0	35.8		
	very high	19.8	31.2		
Controlling for:		Smoker	Yes	16.92***	0.350
			No	13.91**	0.239
		Place	Bristol	12.59**	0.283
			Glasgow	14.15**	0.246
		Social class	Non-man.	12.98**	0.271
			Manual	17.07***	0.299
		Sex	Male	11.79**	0.269
			Female	14.03**	0.249
		Age	<34	13.56**	0.327
			35-54	11.06**	0.268
			>55	n.s.	

Note: * p<0.05, **p<0.001, ***p<0.001

'Hedonic motivations' was consistently significant in discriminating between consumption levels. Higher vegetable consumers rated 'hedonic motivations' as important, while lower vegetable consumers did not. This relationship was observed across all socio-demographic conditions, except amongst the over 55s, suggesting this was a very strong influence on vegetable consumption.

Table 7.7 *Convenience by vegetable consumption, controlling for socio-demographic variables*

		Vegetable consumption (%) Low	M-High	χ^2	Cramer's V
Convenience	very low	19.4	32.4	8.88*	0.131
	low	25.3	24.3		
	high	27.2	22.5		
	very high	28.1	20.8		
Controlling for:		Smoker	Yes	n.s.	
			No	n.s.	
		Place	Bristol	n.s.	
			Glasgow	n.s.	
		Social class	Non-man.	11.84**	0.259
			Manual	n.s.	
		Sex	Male	n.s.	
			Female	n.s.	
		Age	<34	n.s.	
			35-54	14.03**	0.302
			>55	n.s.	

Note: * p<0.05, **p<0.001, ***p<0.001

There was a significant difference between high and low consumers in terms of 'convenience', with lower consumers more likely to agree this is important. Among the socio-demographic sub-groups, 'convenience' was fairly weak in distinguishing between consumers. Only within the non-manual social group and 35-54 age group were there significant relationships between high and low consumers in terms of convenience. Where there was a significant difference, higher consumers agreed more with this factor than low consumers, who generally disagreed.

Of the composite motivation, attitude and belief variables, the most significant at discriminating between high and low vegetable consumers related to 'hedonic motivations'. Those with higher vegetable consumption tend to agree that 'hedonic motivations' are more important, than those who are low consumers. Also of importance were motivations relating to 'longer term motivations'. Both these factors were expected to produce such a result based on the association of individual attitude and belief statements with vegetable consumption, from section 7.1.1. 'Convenience', while significant in distinguishing between high and low consumers overall, was of less importance when socio-demographic sub-groups were considered.

7.2.4 Marketing influences on vegetable consumption

All the marketing related variable as detailed in section 5.6.2., were analysed in cross-tabulation with vegetable consumption, except the variables measuring 'perceived expense' and 'ease of availability', which were included in the earlier analysis (although the relationship between these variables and vegetable consumption was not reported in detail, since they were not significant).

As with fruit consumption, there appeared to be no significant difference between high and low consumers for any of the marketing variables. Consideration of these cross-tabulations, at the socio-demographic sub-group level, showed a few minor significant differences. There was a difference in the mode of transport used to buy vegetables among the Glasgow sub-group, and among the 35-54s, with higher consumers using the car more than any other form of transport (with $\chi^2 = 9.806$, $p = 0.007$, Cramer's V = 0.205 and $\chi^2 = 0.029$, $p = 0.007$, Cramer's V = 0.255 for the respective sub-groups). There was also a difference in distances travelled among the Glasgow sub-group, where higher consumers travelled 1-3 miles, while lower consumers travelled less than 1 mile ($\chi^2 = 6.600$, p 0.037, Cramer's V = 0.168).

Since these significant differences were so few (only three in total), it was thought these marketing influences should not be included in the subsequent modelling of vegetable consumption.

7.3 Correlations between significant variables influencing vegetable consumption

The Spearman's rank correlation coefficient was used to examine the nature of the relationship (if any) between the significant variables influencing vegetable consumption, and to explore issues of collinearity. As in Table 6.12, there were no correlations between any of the socio-demographic variables.

Table 7.8 presents correlations between each of the significant motivation, attitude and belief variables (in original form) and with the significant latent variables ('Long term motivations', 'hedonic motivations' and 'convenience').

Table 7.8 ***Correlations between significant attitude and belief variables (original and latent) influencing vegetable consumption.***

Variable	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*
A. Not messy to eat	1.00										
B. Cheer me up	0.26	1.00									
C. Interesting	0.18*	0.58	1.00								
D. Variety of textures	0.16*	0.45	0.66	1.00							
E. Variety of flavours	0.05 ^{ns}	0.36	0.58	0.73	1.00						
F. Comforting	0.34	0.73	0.51	0.43	0.37	1.00					
G. Subjective norm	-0.01 ^{ns}	0.24	0.31	0.39	0.36	0.21	1.00				
H Protective effect	-0.01 ^{ns}	0.23	0.18*	0.30	0.31	0.18*	0.58	1.00			
I. Behavioural intention	0.15*	0.20	0.22	0.30	0.24	0.17	0.44	0.58	1.00		
J. 'Long term motivations'	0.04 ^{ns}	0.17*	0.20	0.37	0.37	0.13	0.85	0.721	0.77	1.00	
K. 'Hedonic motivations'	0.19	0.79	0.81	0.76	0.70	0.77	0.80	0.20	-0.08 ^{ns}	0.23	1.00
L. 'Convenience'	0.84	0.36	0.19	0.14	0.03 ^{ns}	0.50	0.17	0.85	0.34	0.34	0.24

Note: All correlations are significant at $p < 0.001$, except * = $p<0.05$, ** = $p<0.01$, ^{ns} = not significant

Variables measuring various aspects of each of the latent variables, tend to correlate strongly with each other and with the latent factor. For example, B, C, D, E and F (measuring aspects of hedonic motivation) above all correlate strongly with 'hedonic motivation', as well as with each other. This indicates this latent variable is a good composite measure of the motivations. The same is observed for the other latent variables, i.e. 'messy to eat' correlates strongly with the convenience factor, and subjective norm and protective effects correlate with 'long term motivations'. When the effects of the socio-demographic variable were partialled out, the values remained at a comparable level, as did the correlations between variables when the effects of the factor variables were partialled out (tables not shown here).

7.4 Intermediate summary

The bivariate analysis suggested that socio-demographic variables were not very significant in influencing vegetable consumption. The most important of the socio-demographic variables (although weak and inconsistent) were 'age' and 'social class'. Of the motivation, attitude and belief variables, the most important was that relating to 'hedonic motivations'. Both the factor variable, and the items measuring the components of hedonic motivations, showed significant differences between high and low consumers of vegetables along this dimension (higher vegetable consumers had higher ratings).

Other relevant attitude and belief latent variables were 'longer term motivations' and 'convenience'. These were all included in the multivariate modelling, which followed the same approach as that for fruit.

7.5 Extent of variables' influence on vegetable consumption model: Log linear analysis

The following analysis models the relationship between vegetable consumption and the socio-demographic variables. Age and class both have main effects, as well as interaction effects, on vegetable consumption. While there was no main effect of either place or smoker status on vegetable consumption, the bivariate analysis (Section 7.2.1) suggests these variables have an important interaction effect (since some sub-groups showed significant differences). Sex, housing type and presence of children were omitted from the modelling as earlier bivariate analysis indicated there was no influence of sex, housing type or presence of children on vegetable consumption. Thus, the log linear model includes the socio-demographic variables age, social class, place and smoker status. The same underlying structure to the socio-demographic variables was used in the development of the vegetable model. The model of socio-demographic variables developed in section 6.3.1.1., applies whatever variables are used as dependent variables (i.e. it is not the structure of the socio-demographic variables relative to any particular dependent variable).

A logit model was developed, taking the log linear model (6.3.1.1.) as its base, with vegetable consumption as the dependent variable.

7.5.1 Logit model of vegetable consumption and socio-demographic variables

The hypothesis for the model best explaining relationship between vegetable consumption and the socio-demographic variables is one where the odds of vegetable consumption depended on age, social class, place and smoking status (in that order from initial bivariate analysis) and the interaction between place, age and social class (from the log linear modelling). For this analysis V represents vegetables, P represents place, C represents social class, A represents age and S represents smoker status. Again, letters (variables) hypothesised by the model to be related are enclosed within curly brackets. Thus, {PAC} is interpreted as a model where place, age and social class are related, while {S}{PAC} indicates a model where smoker status is not related to place, age and social class. The hypothesised model best explaining the data is (VPAC) (VS), that there is an independent effect of each of smoking, place, age and class on vegetable consumption, and the interactive effect of place, age and class. As before with the fruit model, the logit model building began by considering the goodness-of-fit tests for several loglinear (logit) models. Models with independence, 2-factor terms, 3-factor terms and 4-factor terms were compared and are described as follows.

Table 7.9 ***Logit model for vegetable consumption and the socio-demographic variables***

	Model	L^2	*d.f.*	*p*	*Improvement in fit of model*[1]
1	{V}{P}{A}{C}{S}	66.91	41	0.006	0.005
2	{VP}{VA}{VS}{VC}{PA}{PS}{PC}{AS}{AC}{SC}	37.26	27	0.090	<0.01 (1)
3	{VPA}{VPC}{VPS}{VAS}{VAC}{VSC}{PAS}{PAC}{PSC}{ACS}	12.21	11	0.348	0.005 (1)
4	{VPAC}{VPAS}{VASC}{PASC}{VPCS}	5.91	2	0.052	0.025 (1)
5	{PAC}{VA}{VP}{VC}{VS}{AS}{CS}{PS}	30.98	25	0.190	<0.05 (2)
6	{VPAC}{VS}{AS}{PS}{CS}	20.06	18	0.329	<0.05 (2)
7	{VPAC}{VAS}{VCS}{VPS}{ACS}{APS}{CPS}	12.19	9	0.202	n.s. (3)
8a	{VPAC}{AS}{PS}{CS}	20.57	19	0.361	n.s.
8b	{VPAC}{VS}{PS}{CS}	21.39	20	0.374	n.s.
8c	{VPAC}{AS}{VS}{PS}	22.37	19	0.266	n.s.
8d	{VPAC}{AS}{VS}{CS}	20.67	19	0.355	n.s.
9a	{VPAC}{VS}{PS}	23.26	21	0.330	n.s.
9b	{VPAC}{VS}{CS}	21.80	21	0.411	n.s.
9c	{VPAC}{VS}{AS}	23.14	20	0.282	n.s.
9d	{VPAC}{CS}{AS}	21.15	20	0.388	n.s.
9e	{VPAC}{PS}{AS}	23.07	20	0.285	n.s.
9f	{VPAC}{PS}{CS}	21.85	21	0.408	n.s.
10a	**{VPAC}{VS}**	**23.83**	**22**	**0.356**	**n.s.**
10b	{VPAC}{PS}	23.90	22	0.352	n.s.
10c	{VPAC}{AS}	21.81	21	0.302	n.s.
10d	{VPAC}{CS}	22.24	22	0.445	n.s.

Key: P = place, S = smoker status, A = age, C = social class, V = vegetable consumption

The model building procedure was the same as for section 6.3.1.2. The results from this logit analysis imply a model which fits the data fairly well (10a), although not as well as that model fitted for fruit consumption. Agresti (1996) suggests that when model building, hypotheses about the nature of the relationships between variables should guide model selection as much as the goodness of fit statistics. Model 10d provided extra information about the relationship between class and smoking (both independent variables), but no further information about the relationship between vegetable consumption and smoking. For this reason, while the model {VPAC}{CS}(10d) gave the best overall fit (with p= 0.445), the model {VPAC}{VS} (10a) was

[1] i.e. p value for associated Δ in L^2 and d.f. Number in bracket denotes model being compared to, and the term whose contribution is being assessed

accepted as that best explaining the data, for its interpretative purposes, as well as its substantive implications (it contained the logit model, where the dependent variable is considered in relationship with each of the independent variables). While the smoking and class relationship may be of interest, its contribution to the model is not significant; this interaction was not revealed in the initial loglinear modelling amongst the independent variables (6.3.1.1).

The model where vegetable consumption is dependent on the main effects of each of the socio-demographic variables (including smoker status) and dependent on the interaction effect of place, age and class best fitted the data set. The significance level for this model indicates a moderate fitting model. The implication is that another modelling approach, incorporating the motivation, attitude and belief statements, may be better at explaining vegetable consumption (indicated from the earlier bivariate analysis).

To estimate the parameters associated with this model, equivalent logit model was fit using this log linear model as a starting point. The log linear model for {VPAC}{VS} is described as:

$$\ln(F_{ijklm}) = \mu + \lambda_i^{V} + \lambda_j^{P} + \lambda_k^{C} + \lambda_l^{A} + \lambda_m^{S} + \lambda_{ij}^{VP} + \lambda_{il}^{VA} + \lambda_{ik}^{VC} + \lambda_{jl}^{PA} + \lambda_{lk}^{AC} + \lambda_{jk}^{PC} + \lambda_{im}^{VS} + \lambda_{ijl}^{VPA} + \lambda_{ijk}^{VPC} + \lambda_{ilk}^{VAC} + \lambda_{jkl}^{PCA} + \lambda_{ijkl}^{VPAC}$$

Similar to the logit model for fruit consumption, the logit has the additive form:

$$\text{logit}\,\pi = \alpha + \beta_j^{P} + \beta_l^{A} + \beta_k^{C} + \beta_m^{S} + \beta_{jl}^{PA} + \beta_{jk}^{PC} + \beta_{lk}^{AC} + \beta_{jkl}^{PAC}$$

This model above describes the hypothesised situation where the odds of vegetable consumption are dependent on place, class, age, smoker status (separately) and the interaction of place, class and age. The goodness-of-fit statistics for this logit model are $\chi^2 = 13.42$, d.f. = 11, p = 0.267, i.e. a moderate fit to the data.

7.5.2 Interpretation of the logit parameters

The beta parameters were examined to interpret the logit model. Table 7.10 provides these values, showing the beta values and their associated exponential, interpretable as predicted odds.

Table 7.10 *Estimates derived from the logit analysis {VPAC} {VS}*

Term	β^{N}_{1}	exp. β^{N}_{1}	Term	β^{N}_{1}	exp. β^{N}_{1}
V_1	-0.349	0.705	$V_1P_1A_2C_1$	0.726	2.067
S_1V_1	0.248	1.281	$V_1P_1A_2C_2$	-0.726	0.484
A_1V_1	2.048	7.752	$V_1P_1A_3C_1$	-0.151	0.859
A_2V_1	1.552	4.721	$V_1P_1A_3C_2$	0.151	1.163
A_3V_1	-3.6	0.027	$V_1P_2A_1C_1$	-0.425	0.654
P_1V_1	0.401	1.493	$V_1P_2A_1C_2$	0.425	1.530
C_1V_1	-0.434	0.648	$V_1P_2A_2C_1$	-0.726	0.484
$V_1A_1C_1$	0.448	1.565	$V_1P_2A_2C_2$	0.726	2.067
$V_1A_2C_1$	-1.656	0.190	$V_1P_2A_3C_1$	0.151	1.163
$V_1A_3C_1$	1.208	3.347	$V_1P_2A_3C_2$	-0.151	0.859
$V_2A_1C_1$	-0.488	0.614	$V_2P_1A_1C_1$	-0.425	0.654
$V_2A_2C_1$	1.656	5.238	$V_2P_1A_1C_2$	0.425	1.530
$V_2A_3C_1$	-1.208	0.298	$V_2P_1A_2C_1$	-0.726	0.484
$V_1P_1A_1$	-2.63	0.072	$V_2P_1A_2C_2$	0.726	2.067
$V_1P_1A_2$	-0.942	0.389	$V_2P_1A_3C_1$	0.151	1.163
$V_1P_1A_3$	3.572	35.58	$V_2P_1A_3C_2$	-0.151	0.859
$V_2P_1A_1$	2.63	13.87	$V_2P_2A_1C_1$	0.425	1.530
$V_2P_1A_2$	0.942	2.565	$V_2P_2A_1C_2$	-0.425	0.654
$V_2P_1A_3$	-3.572	0.028	$V_2P_2A_2C_1$	0.726	2.067
$V_1P_1C_1$	0.634	1.885	$V_2P_2A_2C_2$	-0.726	0.484
$V_1P_1A_1C_1$	0.425	1.530	$V_2P_2A_3C_1$	-0.151	0.859
$V_1P_1A_1C_2$	-0.425	0.654	$V_2P_2A_3C_2$	0.151	1.163

Key: P = place, S = smoker status, A = age, C = social class, V = vegetable consumption

As for the fruit logit model, the higher the absolute beta value, the greater the impact the independent variable or interaction term has on the odds of the dependent measure occurring. The beta values are interpreted as their effect on low consumption as opposed to medium-high consumption. Positive values raise the odds and negative values lower the odds of the dependent variable (vegetable consumption) occurring. The exponential of β values can be interpreted as the relative odds of being in one category of the dependent variable versus the other.

The main effects for age show the youngest age group have a substantially high probability of being low vegetable consumers (β = 2.048 for <34s, and decreasing as age increases). As age increases the probability of vegetable consumption increases. Being a smoker slightly increases the odds of being a low vegetable consumer (smoker 1.28 times more likely than non-smokers to be low vegetable consumers), as does being in the manual social class (1.5 times more likely than the non-manual to be low vegetable consumers). Those in Bristol are 1.49 times more likely than those in Glasgow to be low vegetable consumers.

As with fruit consumption, it is more illuminating to look at the impact of the interaction of these variables on likelihood of low vegetable consumption (i.e. within the logit model). This can be assessed by systematically inserting the β values, from Table 7.10, into the logit equation that represents the model, i.e.

$$\text{logit}\,\pi = \alpha + \beta_j{}^{P} + \beta_l{}^{A} + \beta_k{}^{C} + \beta_m{}^{S} + \beta_{jl}{}^{PA} + \beta_{jk}{}^{PC} + \beta_{lk}{}^{AC} + \beta_{jkl}{}^{PAC}$$

The probability of low vegetable consumption (or medium-high) can be calculated for each combination of socio-demographic variables, or set of conditions. These probabilities can be calculated and compared to establish how varying levels of the independent variables, in interaction, influence vegetable consumption. Table 7.11 shows the probability of low vegetable consumption (as opposed to medium-high) for each set of conditions, based on the logit model.

Table 7.11 ***Probability of low vegetable consumption based on the logit model {VPAC} {VS}***

	Place	*Social class*	*Age*	*Smoker*	Model	Φ[2]	Expected odds (e^{Φ})
1	Bristol	Non-man.	<34	Yes	$V_1P_1C_1A_1S_1$	0.791	2.206
2	Glasgow	Non-man.	<34	Yes	$V_1P_2C_1A_1S_1$	3.131	22.89
3	Bristol	Manual	<34	Yes	$V_1P_1C_2A_1S_1$	-1.335	0.263
4	Glasgow	Manual	<34	Yes	$V_1P_2C_2A_1S_1$	3.173	23.88
5	Bristol	Non-man.	35 - 54	Yes	$V_1P_1C_1A_2S_1$	0.18	1.197
6	Glasgow	Non-man.	35 - 54	Yes	$V_1P_2C_1A_2S_1$	-1.458	0.233
7	Bristol	Manual	35 - 54	Yes	$V_1P_1C_2A_2S_1$	1.64	5.155
8	Glasgow	Manual	35 - 54	Yes	$V_1P_2C_2A_2S_1$	5.412	224.08
9	Bristol	Non-man.	>55	Yes	$V_1P_1C_1A_3S_1$	1.529	4.613
10	Glasgow	Non-man.	>55	Yes	$V_1P_2C_1A_3S_1$	-7.383	0.0006
11	Bristol	Manual	>55	Yes	$V_1P_1C_2A_3S_1$	-0.985	0.373
12	Glasgow	Manual	>55	Yes	$V_1P_2C_2A_3S_1$	-7.965	0.00035
13	Bristol	Non-man.	<34	No	$V_1P_1C_1A_1S_2$	0.295	1.343
14	Glasgow	Non-man.	<34	No	$V_1P_2C_1A_1S_2$	2.635	13.94
15	Bristol	Manual	<34	No	$V_1P_1C_2A_1S_2$	-1.851	0.157
16	Glasgow	Manual	<34	No	$V_1P_2C_2A_1S_2$	2.677	14.43
17	Bristol	Non-man.	35 - 54	No	$V_1P_1C_1A_2S_2$	-0.316	0.729
18	Glasgow	Non-man.	35 - 54	No	$V_1P_2C_1A_2S_2$	-1.954	0.1417
19	Bristol	Manual	35 - 54	No	$V_1P_1C_2A_2S_2$	1.144	3.1393
20	Glasgow	Manual	35 - 54	No	$V_1P_2C_2A_2S_2$	4.916	136.45
21	Bristol	Non-man.	>55	No	$V_1P_1C_1A_3S_2$	1.033	2.809
22	Glasgow	Non-man.	>55	No	$V_1P_2C_1A_3S_2$	-7.879	0.00037
23	Bristol	Manual	>55	No	$V_1P_1C_2A_3S_2$	-1.481	0.227
24	Glasgow	Manual	>55	No	$V_1P_2C_2A_3S_2$	-8.461	0.00021

Key: P = place, S = smoker status, A = age, C = social class, V = vegetable consumption

These results represent the impact on vegetable consumption based on the *interaction* of the socio-demographic variables. The change in condition from Bristol to Glasgow, in interaction with the other variables, has a substantial impact on the expected odds of low vegetable consumption, with increased odds of low vegetable consumption in Glasgow. This increase in expected odds is consistent at the various levels of the other variables in combination (excluding those where the over 55 age group is included), consistent with the model for fruit consumption. This is a significant result, as main effects analysis (Table 7.10) suggested that the effect of place

[2] using the equation: Φ (logit π) $= \alpha + \beta_j^{P} + \beta_l^{A} + \beta_k^{C} + \beta_m^{S} + \beta_{jl}^{PA} + \beta_{jk}^{PC} + \beta_{lk}^{AC} + \beta_{jkl}^{PAC}$

in isolation was the reverse, i.e. being in Bristol increased odds of low vegetable consumption (by 1.5 times). In combination with the other variables, living in Glasgow increases the odds substantially of low vegetable consumption.

The interactive effect of smoker status was as expected; consistently, those who smoked had greater expected odds of low vegetable consumption.

Class, in interaction with the other variables, had an interesting impact on the odds of low vegetable consumption. The move from the non-manual social class to the manual social class resulted in a decrease in odds of low vegetable consumption, but only for the under 34 and over 55 age groups. With the middle category of age, there was a substantial increase in odds of low vegetable consumption. Being in the non-manual social class group, in interaction with other variables, appears to increase likelihood of low vegetable consumption, although not for the middle age group.

The pattern of the effect of age was erratic. The effect of age at different levels of the variables was not consistent across the categories. However, it was interesting to note that the young and older age groups responded in a similar way to changes in the other variables (i.e. the odds of vegetable consumption changed in the same direction and by similar amounts). This implies these age groups have more similar consumption patterns than those in the middle age group (35-54). This is the opposite of findings for the fruit model, where the <34s and 35-54 group displayed similar patterns.

In conclusion, a logit model was derived, which best explained the relationships between vegetable consumption and the socio-demographic variables. This model was used to produce a set of expected odds of low vegetable consumption, given varying levels of the socio-demographic variables.

Analysis of the main effect of age (Table 7.11) showed age to have an impact on vegetable consumption; as age increased the odds of low vegetable consumption decreased. Place and class also had an impact, but to a lesser extent. Belonging to the manual social class group increased the odds of low vegetable consumption, as did living in Bristol increase the odds. Smokers also had increased odds of low vegetable consumption, although this effect was very small.

In interaction (Table 7.11), place and class both contributed significantly to increasing the odds of low vegetable consumption. Residents in Glasgow were more likely to have low vegetable consumption than those in Bristol, with a similar effect evident for manual social class group as opposed to non-manual social class group. Age had a more irregular effect, with the lower and higher age categories influencing vegetable consumption in similar ways. This was very much dependent on the other variables age was considered in interaction with.

A logistic regression analysis was conducted to explore these interactions with the significant factor variables.

7.6 Relative importance of the factors influencing vegetable consumption: Logistic regression

The logistic regression model for vegetable consumption, was developed using a forward selection approach. From section 7.1.2, three factor variables were found to be significantly related to vegetable consumption. These were 'longer term motivations' (F5), 'hedonic influences' (F6) and 'convenience' (F7). Vegetable consumption was considered as the binary response 1 (low consumption) or 0 (not low, i.e. medium high), and the socio-demographic variables were dummy variables, coded using the deviation approach (Norusis, 1993).

7.6.1 Model selection

As with the previous model development (Section 7.5), the simplest model was used as the starting point, with other terms successively added. Multi-collinearity was dealt with through examination of the correlations between variables (Section 7.3). The socio-demographic variables were all unrelated, and Table 7.8 showed factors 5, 6 and 7 to be significantly, positively correlated, although these correlations were weak, indicating all three factor variables should be included in the analysis, since these variables are not good predictors of each other. These weak, but significant, correlations, were not thought to be problematic.

This model had 7 independent variables. Based on earlier analysis, the simplest estimated model was {PAC}{S}{F5}{F6}{F7}, i.e. the model where place, age and class were interacting and smoker status, F5, F6 and F7 were considered as main effects only. Consecutive bivariate terms were added until the model best fitting the data was achieved. The base model for comparison was the previously entered model. Model building is shown in Table 7.12.

Table 7.12 Results of fitting several logistic regression models to vegetable consumption

Model	Independent variables (model)	-2 Log likelihood	Deviance [3]	d.f.	p	Correct classification (%)
1	P + A + C + S + F5 + F6 + F7	443.783	54.858	7	0.000	69.89
2	PAC + S + F5 + F6 + F7	441.111	2.671	1	0.263	68.23
3	PAC + SF5 + F6 + F7	439.910	1.201	1	0.273	70.72
4	PAC + SF6 + F5 + F7	439.651	0.259	1	0.611	69.89
5	PAC + SF7 + F5 + F6	439.208	0.443	1	0.505	69.89
6	PAC + F5F6 + F7 + S	439.085	0.122	1	0.726	69.61
7	PAC + F6F7 + F5 + S	438.836	0.249	1	0.617	69.34
8	PAC + F5F7 + F6 + S	438.816	0.020	1	0.889	69.06
9	**PAC + SF5F6 + F7**	431.904	**6.912**	**1**	**0.009**	**71.27**

Note: P = place, A = age, C = class, S = smoker status, F5 = long term motivations, F6 = hedonic influences, F7 = convenience

Model 9, including the place, age and class interaction, the interaction of the attitudinal variables long term motivations and hedonic influences with smoker status, and the main effect of convenience, gave the best overall fit of the data (p = 0.009).

Table 7.13 shows the variables in the equation, with measures for the beta values, the exponential of the beta values, significance levels and the R values.

[3] Model chi-square (the difference between -2LL when only the constant is included in the model and that for the current model)

Table 7.13 **_Variables in equation_**

Variable	Log odds (β)	Odds (exp. β)	sig.	R	Wald
Age (1)	0.5606	1.752	0.0020	0.131	9.539
Age (2)	-0.027	0.973	0.869	0.000	0.027
Class (1)	-0.103	0.902	0.398	0.000	0.714
Place (1)	0.024	1.025	0.845	0.000	0.038
Smoker (1)	0.0858	1.088	0.515	0.000	0.423
V5	-0.440	0.644	0.005	-0.116	7.963
V6	-0.619	0.539	0.0001	-0.178	15.95
V7	0.723	2.061	0.000	0.192	18.102
A(1) C(1) P(1)	0.136	1.146	0.435	0.000	0.609
A(2) C(1) P(1)	0.169	1.185	0.306	0.000	1.048
A(3) C(1) P(1)	-0.305	1.356			
S(1) V5	-0.181	0.834	0.243	0.000	1.359
S(1) V6	-0.128	0.879	0.409	0.000	0.683
S(1) V7	0.135	1.145	0.372	0.000	0.796
V5 V6	-0.182	0.833	0.130	-0.206	2.289
V6 V7	0.073	1.076	0.561	0.000	0.337
V5 V7	0.015	1.015	0.912	0.000	0.012
S(1) V5 V6	-0.314	0.730	0.008	-0.107	7.069
constant	0.244		0.077		3.118

Note: Base categories are Age 1 = 34, Class1 = non-manual, Place 1 = Bristol, Smoker 1 = Smoker, F5 = long term motivations, F6 = hedonic influences, F7 = convenience

The exponential beta value provides the increase in odds of low consumption as a result of increasing the value of the variable by 1 (i.e. change to next category for socio-demographic variables and increasing value for latent attitude and belief variables).

7.6.2 Interpretation of model

The logistic coefficient (β) was interpreted as the change in the log odds associated with a one unit change in the independent variable. 'Convenience' was the only variable which had an individual effect. As ratings for convenience increased, the log odds of being a low consumer were 0.723, i.e. those who thought convenience was important were 2.06 times more likely to have low vegetable consumption.

The interaction effects were interpreted by considering how the exp.(β) values changed with different levels of the variables. The interaction of age, class and place had a log odds of 0.136 for under 34s, 0.169 for 35-54 year olds and -0.305 for over 55s. The log odds value, for under 34s, was the change in log odds of low consumption as a result of increasing the value of place and class for the under 34 age group. A change in place from Bristol to Glasgow and in class from non-manual to manual for under 34s lead to the odds of being a low vegetable consumer changing by a factor of 1.146 (slightly increased). The same interaction conditions, but with age in the middle age group lead to an increase in the odds of being a low vegetable consumer (odds of 1.185), and a decrease for the over 55 age group (0.737).

The interaction of smoker status, hedonic motivations and longer term motivations altered the odds of low vegetable consumption by a factor of 0.730 (i.e. non-smokers and those with higher ratings for hedonic motivations and longer term motivations were less likely to be a low vegetable consumer).

Smoker status had a slight main effect on vegetable consumption to the opposite (1.088, interpreted as non-smokers were slightly more likely to be a low consumer), but in combination with 'hedonic motivation' and 'longer term motivation' this was reversed, fitting expectations.

Consideration of the absolute values of the exponential beta values gave an indication of the relative impact of each of the independent variables (individually and in interaction). These effects suggested 'convenience', followed by 'hedonics' and then 'long term motivations' had important effects on the probability of being a low vegetable consumer as opposed to a high vegetable consumer. Of the socio-demographic variables, age was the most significant main effect. The most significant interaction term was that of smoker status with hedonics and long term motivations.

7.7 Relative importance of factors influencing vegetable consumption: Discriminant analysis

7.7.1 Research design of the discriminant analysis

The dependent variable was vegetable consumption, categorised as low and med-high consumption, and the independent variables were age, smoker status, place, class (all in dummy form), 'long term motivations', 'hedonic motivations' and 'convenience' (all emerging from the earlier analysis as significant variables influencing vegetable consumption).

Again the sample was split 60:40, with randomly assigned cases appearing in the analysis once only. The analysis sample consisted of a random 60% of total cases (230) and the holdout consisted of approximately 40% (160). The total sample provided a 45.25:1 ratio of observations to independent variables (362[4] observations for 8 potential independent variables). This ratio was 28.75:1 for the analysis sample, and 20.87:1 for the holdout sample, both greater than the minimum 20:1 ratio suggested by Hair et al, 1995.

For the total sample the two groups of consumers (low and medium-high) contained 198 and 164 observations respectively, making them comparable in size not to impact either the estimation or the classification processes. For the analysis sample, the breakdown was 128 low consumers and 102 med-high consumers, and for the holdout sample this is 79 low and 53 medium-high consumers.

7.7.2 Assumptions of discriminant analysis

The assumptions for discriminant analysis are normality of multivariate distributions, and equality of variance-covariance matrix. There were three continuous variable included in this analysis ('convenience', 'long term motivations' and 'hedonic motivations') and these all

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[4] 390 cases minus 28 missing discriminating variables.

approximated to normality[5]. All other variables included in the analysis were dummy coded variables, where normality was not of concern.

To test the equality of variance-covariance, the Box's M test was applied, with values over 0.05 desirable. For discriminant analysis of vegetable consumption, the significance of difference in the covariance matrices between the two groups was 0.395 for the analysis sample and 0.406 for the holdout sample, of comparable order and within acceptable limits.

7.7.3 Estimation of the discriminant function and assessing overall fit

The tables and findings were presented first for the analysis sample, and then classification and relevant statistics for the holdout sample. A profile of group statistics enhanced the validation of the results, allowing for profiling of group differences. Table 7.15 shows the unweighted group means and standard deviations for each of the independent variables.

Table 7.14 ***Group descriptive statistics***

Group means	X	1	2	3	4	5	6	7	8	Sample size[6]
Low	1	-0.165	-0.176	0.136	0.353	0.396	0.405	0.448	0.431	128
Med_hi	2	0.258	0.224	-0.138	0.244	0.393	0.383	0.489	0.32	102
Total		0.023	0.003	0.0133	0.305	0.395	0.395	0.466	0.4008	230

Std. dev.	X	1	2	3	4	5	6	7	8	Sample size
Low	1	0.888	1.036	0.925	0.480	0.491	0.493	0.499	0.497	128
Med_hi	2	0.922	0.955	1.029	0.432	0.496	0.489	0.502	0.483	102
Total		0.925	1.018	0.980	0.461	0.490	0.490	0.500	0.491	230

Key: X = Vegetable consumption, 1 = longer term motivations, 2 = hedonics, 3 = convenience, 4 = Under 34 (age 1), 5 = 35-54 (age 2), 6 = place, 7 = social class and 8 = Smoker status

[5] Variable F5 (long term motivations) displayed a slight negative skewness, but a square root transformation (as advised in Hair, 1995) did not improve this situation. With a skewness value of -0.967 (s.e. skew 0.126) and kurtosis value of 1.631 (s.e. kurtosis 0.252) it was felt that this was an acceptable level.

[6] The difference from the total sample is due to cases being omitted form analysis due to missing discriminating variables. Also an approximate random sample appears to have been taken, thus leading to a situation where some cases were included twice

An assessment of the significance between means of the independent variables for the two groups is shown in Table 7.15.

Table 7.15 Test for equality of group means between low and med_high consumers of vegetable

	Independent variables	Wilk's lambda	Univariate F ratio	Sig.
1	Long term motivations	0.96768	7.6145	0.0063
2	Hedonic motivations	0.95123	11.6906	0.0007
3	Convenience	0.96898	7.2999	0.0074
4	Age (1 = <34, 0 = over 35)	0.98243	4.0780	0.0446
5	Age (1 = 35-54, 0 = under 34 and over 55)	0.99913	0.1974	0.6572
6	Place (1 = Bristol, 0 = Glasgow)	0.99941	0.1345	0.7142
7	Social class (1 = non-manual, 0 = manual)	0.98197	4.1863	0.0419
8	Smoker status (1 = smoker, 0 = non-smoker)	0.99364	1.4598	0.2282

This shows there is a highly significant difference between groups for the factor variables (Long term motivations, Hedonic motivations, Convenience), and less significant differences for Age 1 (the effect of being under 34) and social class.

7.7.3.1 Estimation of the discriminant function

The discriminant function was estimated using a step-wise procedure. All the variables were initially excluded from the model, and added one by one until a point was reached where adding more variables did not provide better discrimination between the groups. Values for Wilk's lambda and the univariate F ratios (Table 7.15) guided the stepwise discriminant procedure, indicating variables for inclusion and at which step. Thus, 'hedonic motivations' was the first variable included in the procedure.

The discriminant weights and loading for the function are reported in Table 7.16. The independent variables were screened by the stepwise procedure and were significant enough to be included in the function.

Table 7.16 Discriminant function[7], with standardised weights, discriminant loadings and ANOVA

	Standardised weight	*Structure matrix - Discriminant loadings*		*Univariate F ratio*	
Variable	Value	Value	Rank[a]	Value	Rank
Long term motivations	-0.360	-0.425	2	7.6145	2
Hedonic motivations	-0.692	-0.527	1	11.6906	1
Convenience	0.811	0.416	3	7.2999	3
Age 1 (1 = <34, 0 = over 35)	0.462	0.311	4	4.0780	5
Age 2 (1 = 35-54, 0 = under 34 and over 55)	NI	-0.305	5	0.1974	7
Place (1 = Bristol, 0 = Glasgow)	NI	-0.180	6	0.1345	8
Social class (1 = non-manual, 0 = manual)	NI	-0.019	7	4.1863	4
Smoker status (1 = smoker, 0 = non-smoker)	NI	-0.015	8	1.4598	6

Note a) Ranking is in terms of absolute value, irrespective of sign.

The independent variables were ranked in terms of the weights (standard discriminant function coefficient) and loadings for the function (from structure matrix). These both provide indicators of the discriminating power of the independent variables.

This discriminant function was highly significant, but had a canonical correlation value of only 0.395, i.e. 15.6% (0.395^2)of the variance in the dependent variable was explained by this model.

7.7.3.2 Assessing overall fit

The predictive accuracy of the discriminant function was assessed, through the classification matrices. With group centroids of 0.382 for low consumers and -0.479 for medium high consumers, the classification matrix was devised, where individuals were classified as *low* consumers when their discriminant score was *positive* and *medium high* when their score was *negative.* The C_{pro} value was 0.507, indicating 50.7% chance of correct classification. With a chance accuracy of 50.7%, the classification accuracy should be at least 63.38% (i.e. at least 1/4 greater than that achieved by chance). The classification accuracy for this example was 66.67% indicating a better than 'chance' prediction of group membership. To further support this

[7] 68.27% were correctly classified, with a Box's M value of 43.67 (p = 0.003)

classification as better than 'chance', Press's Q was calculated[8]. For this sample Press's Q equalled 27, which exceeded the critical value of 6.63 for 1d.f. and 0.01 confidence level. This was statistically significant, and prediction was considered to be better than chance.

7.7.4 Interpretation of the discriminant function

Table 7.16 provides an indication of the relative importance of each of the variables included in the model. 'Hedonic motivations' was the best discriminating variable, followed by 'long term motivations' and then 'convenience'. For these factor variables low consumption was characterised by low ratings. Age was next in important, followed by place. Social class and smoker status had little significant impact on vegetable consumption.

To investigate which consumption group an individual would fall into, the standardised weights (Standardised Canonical Discriminant Function) were used:

D (x) = 0.811 'Convenience' - 0.692 'Hedonics' + 0.462 Age1

- 0.360 'Long term motivations'

Using the group means (group centroids), with low = 0.382 and medium high = -0.479, it was possible to determine group membership (low or medium high) in terms of category of each of the variables.

The discriminant function was therefore defined as follows:

For function 1 to have a mean of 0.382 for group LOW, 'convenience' ratings must be high, 'hedonics' must be low, age1 must be positive (i.e. <34) and 'long term motivations' must be low[9].

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[8] Where Press's Q = $[N - (n*k)]^2/N\ (k-1)$

[9] i.e. maximise the chances of summating to a positive value. If, for example, convenience rating was low, this would result in a low overall value for the function, since this is a variable which contributes greatly to the model. This would reduce the chance of a total positive value for the function.

Thus, low vegetable consumption was characterised by:

Variable	*Description*
Convenience	High rating
Hedonic motivation (F6)	Low rating
Long term motivations (F5)	Low rating
Age	<34

A high score for convenience characterises low consumption, in contrast to the low scores for the other factor variables for low vegetable consumption. Those who thought convenience was important, tended to have low vegetable consumption, implying vegetables are not perceived as such, constraining consumption. The opposite would apply for medium-high consumption of vegetable.

7.7.5 Validation of the discriminant results.

The holdout sample came from the main sample and was not used in the main analysis. The discriminant function was directly applied to the remaining sample, performing at an acceptable level in classifying the participants. Correct classification was of a similar order to the analysis sample; 68.93% of cases were correctly classified. The C_{pro} value was 0.500, within the value required, and the Press's Q value for the holdout sample was 25.36, exceeding the critical value of 6.63 and making it an acceptable level of classification. Overall acceptable levels on measures of predictive accuracy were found in the holdout sample, implying good internal validity. As for the fruit model, external validity was not established.

7.8 Vegetable model for those with a commitment to act

As with the fruit consumption, a model was derived for those with a positive behavioural intention only, i.e. those who had some commitment to consuming vegetables.

Because the nature of the impact of the variable may differ from the earlier analysis which considered the total sample, all latent and socio-demographic variables (in dummy form) were included to see which contributed to the model. Deleting those which were not significant (to improve model fit) resulted in the model, outlined in Table 7.17.

Table 7.17 ***Discriminant model of fruit consumption, for those with commitment to act***

	Std. weights	Discriminant loading	Rank
Age 1	0.419	0.168	5
Long term motivations	-0.415	-0.384	3
Hedonic motivation	-0.630	-0.385	2
Convenience	0.796	0.491	1
Family influences	0.439	0.309	4
Age 2	NI	-0.166	6
Place	NI	-0.166	7
Smoker status	NI	0.1003	8
Class	NI	-0.065	9

This analysis was run for the whole sample (not with holdouts as the previous discriminant analysis were), due to sample size constraints. The model has a good fit with Box's M of 0.070, correct classification of 65.3%, Press's Q of 31.06 and explained 16.03% of the variance. The final model was:

$$D(x) = 0.796 \text{ 'Convenience'} - 0.630 \text{ 'Hedonics'} + 0.439 \text{ 'Family'} + 0.419 \text{ Age1} - 0.415 \text{ 'Longer term motivations'}$$

The model for those committed to eating more vegetables shows similar variables to be very important, and in a similar order, as for the model of vegetable consumption overall. However, a new influence, to this model, appears to be that of 'family influences', making a fairly important contribution to this model.. This model suggests that when 'family influences' are rated high (i.e. they are important) then consumption of vegetables tend towards low, rather than high. This is an interesting finding as it suggests that the family act as an impediment to consumption, even when the individual is motivated to consume vegetables. As with the earlier discriminant model of vegetable consumption, only one socio-demographic variable, age, significantly impacts upon consumption.

In summary, when committed to consumption of vegetables, low consumption is characterised by:

Variable	*Description*
Convenience	High rating
Hedonic motivation	Low rating
Family influences	High rating
Age	<34
Long term motivations	Low rating

In the factor analysis (Section 5.4.3.3), 'long term motivation' was the latent variable (factor) along which the 'behavioural intention' item correlated. The discriminant analysis was run, omitting this factor variable, to investigate how any changes in the model. The resulting discriminant model was:

$$D(x) = 0.943\ \text{'Convenience'} - 0.733\ \text{'Hedonics'} + 0.534\ \text{Age}$$

This model had Box's M of 0.448, correct classification of 65.30% cases, Press's Q of 20.5 (acceptable), and explained 11.4% of the variance. This omission of the factor variable provides an adequate model, although explains less variance than the previous model. Bearing in mind that its exclusion leads to the exclusion of subjective norm and long term health beliefs, it was thought preferable to accept the model presented in table 7.17.

7.9 Impediments to vegetable consumption.

The discriminant model of vegetable consumption was very similar to that built for those with a positive behavioural intention, except for the inclusion of 'family influences' in the second model. This would suggest that the influence of the family represents a significant constraint on consumption, even when one is motivated to eat vegetables. It seems that satisfaction of the family's needs and wants (as a unit) takes precedence over that of individuals, or at least the control individuals feel.

7.10 Summary of vegetable consumption results

The main findings from each of the analyses are presented in Table 7.18. The table includes the influencing variables and the strength and nature of each influence on vegetable consumption.

Table 7.18 ***Summary of results of factors influencing vegetable consumption***

Analysis Section	*Influencing variable*	*Strength*	*Nature of influence on vegetable consumption*
7.2 Bivariate	Social class	W	Manual led to low consumption
	Place	VW	Glasgow tended to have low consumption
	Smoker status	VW	Smoking led to low vegetable consumption
	Age	FW	35-54 were highest vegetable consumers
	'Long term	S	Lower ratings for low consumers
	motivations'	VS	Lower ratings for low consumers
	'Hedonic influences'	FS	Lower ratings for low consumers
	'Convenience'		
7.5 Loglinear model	Smoker status (main effect)	W	Smokers had increased odds of low vegetable consumption
	Age (main effect)	FS	35-54 had decreased odds of low consumption <34s and >55s respond varying condition similarly
	Place (interaction)	FW	Glasgow had increased odds of low vegetable consumption
	Social class (interaction)	FW	Erratic, dependent on conditions. Non-manual social class group appears to increase likelihood of low vegetable consumption
7.6 Logistic regression	Age, class and place (interaction)	FW	All three interact, with Glasgow and manual consistently leading to lower consumption. Effect of age varies with other conditions
	Smoker status, 'long term motivations' and 'hedonic motivations' interaction	F	Non-smokers and those with positive ratings for hedonic and long term motivations were likely to be higher vegetable consumers.
	'Convenience' main effect	S	Those who rated high on this (i.e. though convenience was important) had low vegetable consumption.
7.7 Discriminant analysis (total sample)	'Convenience'	S	Higher ratings for low consumers
	'Hedonic motivations'	S	Lower ratings for low consumers
	'Long term	F	Lower ratings for low consumers
	motivations'	FS	<34 have low consumption
	Age		
7.8 Discriminant analysis (positive behavioural intention only)	'Convenience'	S	Higher ratings for low consumers
	'Hedonics'	S	Lower ratings for low consumers
	'Family'	FS	Higher ratings for low consumers
	Age1	FS	<34 have low consumption
	'Long term motivations'	FS	Lower ratings for low consumers

Key: For the *log linear model*, labels were assigned on the basis of beta values, where S = greater than 2.30 (strong), FS = 1.95 - 2.29 (fairly strong), F = 1.61-1.94 (fair), FW = 1.01 - 1.60 (fairly weak), and W = less than 1(weak). For the *bivariate*, strength was rated on the basis of significance level, and Cramer's V. For *discriminant and logistic regression analysis*, where a weighting was given, S = greater than 0.5 (strong), FS = 0.4 - 0.49 (fairly strong), F = 0.3 - 0.39 (fair), FW = 0.2 - 0.29 (fairly weak), and W = less than 0.19 (weak).

These analyses has shown that there are many variables influencing vegetable consumption. The motivation, attitude and belief factor variables were most important in explaining differences in high and low consumption levels. The bivariate analysis suggested that the 'hedonics' were the most important of the factor variables, but the multivariate analysis showed the latent variable 'convenience' to be the best explanatory variable for vegetable consumption. 'Longer term motivations' also influenced vegetable consumption, although not as substantially as 'convenience' or 'hedonic motivations'. When the model was developed for those with a positive behavioural intention to consume vegetables, the influence of the 'family' emerged as a very significant constraint on consumption. Interestingly, this latent variable was not particularly strong, as an influence on all consumers, in the earlier bivariate analysis.

Of the socio-demographic variables, the evidence was not as clear. The main effects of each varied depending on the type of analysis. The loglinear analysis showed place to have a very strong impact on vegetable consumption, in interaction with the other variables, as had smoker status. The discriminant analysis showed only age to have any significant impact on vegetable consumption, remaining the case when those with a positive behavioural intention were modelled. Overall the explanatory power of the socio-demographic variables was fairly weak.

From these models of vegetable consumption behaviour, it is clear that the factor variables, measuring the motivations, attitudes and beliefs in relation to vegetables, were best at explaining differences between high and low consumers. Of the socio-demographic variables, the most important was age.

7.11 Spatial representation of vegetable consumption model

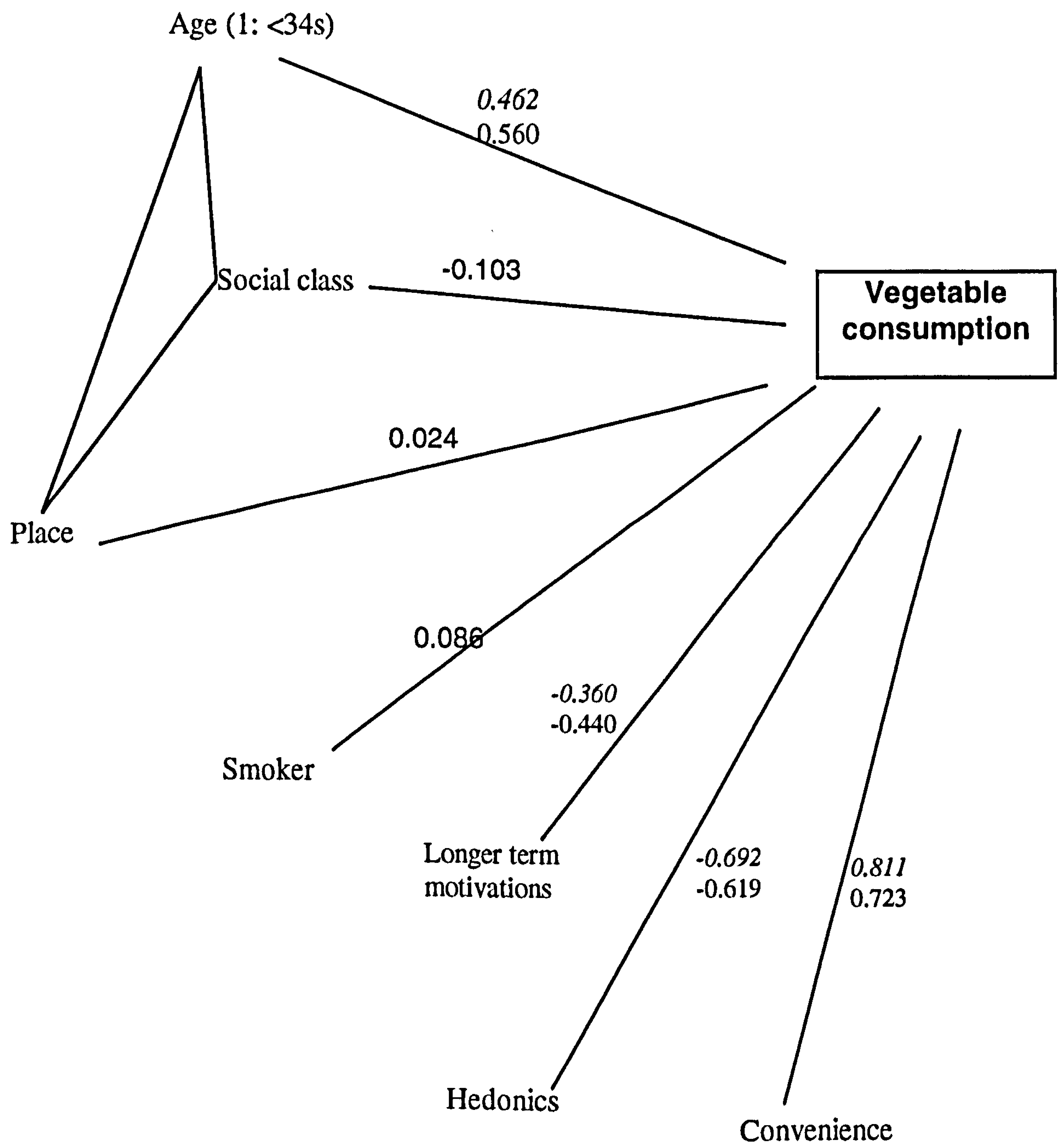
The final stage of this analysis of vegetable consumption is to present the final model, based on the model proposed in Chapter 2 and then Chapter 4, displayed in Figure 7.1. This figure shows the relationship between vegetable consumption and the significant predictor variables, both spatially and quantifying the extent of the relationships.

As with the fruit model, the reported weights are those from the discriminant model and the logistic regression model. Where only one value is shown, it is because that variable was not included in the discriminant analysis, and as such has no associated weighting. The log linear findings assisted in the spatial presentation of the variables.

Figure 7.1 shows the vegetable model for the total sample. The main influence on vegetable consumption was related to the product itself (categorised under marketing influences in the previous Figures, 2.3 and 4.1), and related to the 'convenience' of vegetables. However, this could arguably be included as an internal influence, since the factor consists of beliefs and attitudes in relation to convenience. Other important psychological influences of importance were 'hedonic motivations', followed by 'longer term motivations', a weaker influence on vegetable consumption. Of the personal characteristics, only age was an important influence on vegetable consumption.

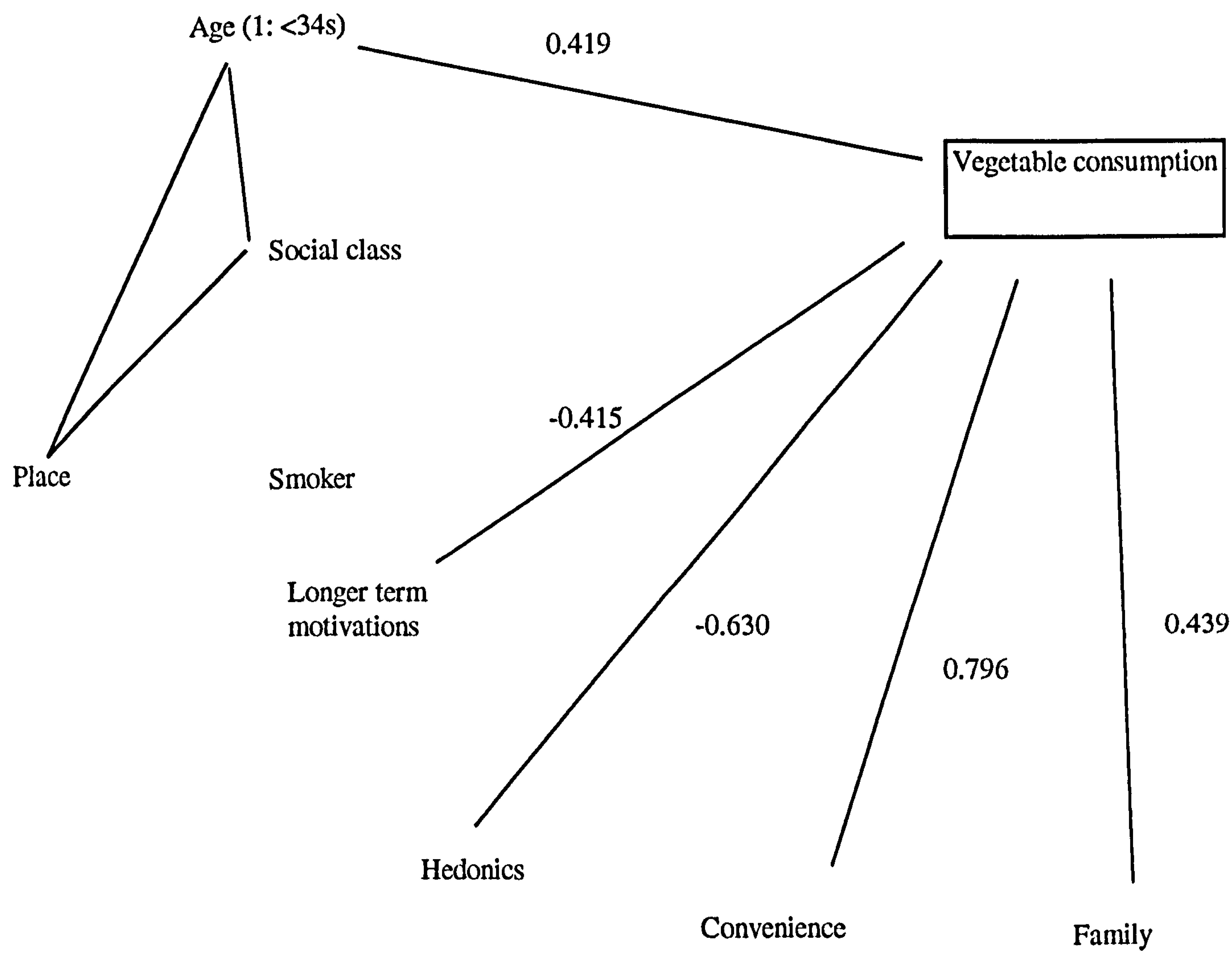
For those with a positive behavioural intention to eat more vegetables (Figure 7.2), there was not much difference in the order or magnitude of the important factors. However, the external influence of the family, had a greater impact for this model, suggesting this is an important constraint on those motivated to consume vegetables.

Figure 7.1 The final model of vegetable consumption based on the total sample[10]*.*



[10] Values are given for *discriminant weight*, and then logistic regression.

Figure 7.2 The final model of vegetable consumption for those with a positive behavioural intention[11]



[11] All weight are from the discriminant analysis only

Chapter 8 Discussion and conclusions

8.1 Introduction

This chapter concludes the thesis, drawing together and examining the various issues raised by the study. The initial aims are reviewed, and the main findings from this work are discussed in the context of previous work. Then the practical implications for increasing fruit and vegetable consumption are explored. A reflection on the work follows, discussing first the role of place in explaining fruit and vegetable consumption, then the limitations of the research and steps taken to minimise the effects of these. Finally, some possible research directions are highlighted.

The study made contributions to knowledge in several areas. The first contribution was in identifying important differences between fruit and vegetable consumption behaviour. Secondly, these differences led to the development of separate models of fruit and vegetable consumption. A further contribution to knowledge was made in the area of food choice modelling and food choice theory, by suggesting that a generic model of food choice may be an unattainable goal.

8.2 Fruit and vegetable consumption

8.2.1 Aims

The main aim of this study was to build a comprehensive model of fruit and vegetable consumption, systematically modelling the influences on this consumption behaviour. The review of the literature suggested there were three main sets of influences on fruit and vegetable consumption, i.e. those relating to the food, the person and from the marketing environment. The literature also revealed there were weaknesses and strengths attached to each of the theories discussed, and that no one theory was particularly suitable for analysing fruit and vegetable consumption. The main limitation of the expectancy–value attitudinal models was that the perceived behavioural control element (introduced to the Theory of Planned Behaviour to improve its predictive ability) did not consistently predict behavioural intention, nor did it cover the range of influences (facilitators and constraints) intervening between intention formation and action. The second theory considered was the Theory of Goal Directed Behaviour which focuses on the impediments to action once the individual was motivated to consume (i.e. a commitment to action had been formed). The present research, however, was interested in those with low consumption or not motivated to eat fruit and vegetables, so the Goal Directed approach was not entirely suitable for this study. While there were theoretical insights offered by each of these theories, it appeared a hybrid theoretical perspective was required, which explored attitudes and beliefs, as well as experiential, or hedonic, aspects of consumption.

From the review of the literature it was clear that the main influences on fruit and vegetable consumption, and the nature of their influence and interaction, were very complex. The first objective of this study was to obtain a further understanding of the range of important factors influencing fruit and vegetable consumption. A methodological approach was required which made it possible to establish the important influences on fruit and vegetable consumption, and also to explore the relevant theoretical constructs of this behaviour. The focus group methodology (a qualitative technique) was employed since it allowed in-depth questioning and probing about a range of influences on consumption. Hence, the qualitative stage of the research (reported in Chapter 4) resulted in a framework of the range of factors influencing fruit and vegetable consumption, thereby meeting the first objective of the research. This qualitative analysis revealed that certain social influences (e.g. the family), which are key components of the Theory of Planned Behaviour, were important for fruit and vegetable consumption. However, motivations relating to the hedonic, or experiential aspects of fruit and vegetable consumption, also seemed to be very important for consumption, particularly amongst the lower socio-economic groups. This supports the earlier suggestion that the Theory of Planned Behaviour was not an entirely appropriate model for exploring this behaviour, since explicit measures of hedonic motivation are not included in the Theory of Planned Behaviour.

The second objective of the study was to determine the nature of the interaction of these factors on fruit and vegetable consumption. The propositions, emerging from the literature and qualitative stage, were more formally examined in the form of a questionnaire administered in Glasgow and Bristol. A questionnaire was developed to capture all the main issues emerging from the qualitative research, as well as some theoretical constructs included to aid subsequent modelling (related to the Theory of Planned Behaviour and Theory of Goal Directed Behaviour). Multivariate statistics were applied to develop separate models for each of fruit and vegetable consumption, based on the data provided by the questionnaire. The modelling procedure was to establish a parsimonious, or simple, representation of the complex behaviour of fruit and vegetable consumption. By analysing the relative importance of and the relationship between variables, these models of fruit and vegetable consumption were established.

8.2.2 Main findings

The main results from this research are summarised as follows:

8.2.2.1. Low fruit and vegetable consumption prevailed

The focus of the research was to determine the influences on fruit and vegetable consumption behaviour. The behaviour (i.e. consumption levels) of the sample population suggests that consumption of both fruit and vegetables was very low. More than half the total sample (59.7%) reported fruit consumption levels which were classified as low, and 55.6% reported low vegetable consumption. While the validity of the instrument for consumption measurement may have been problematic, these levels are not dissimilar to those reported by another recent study in Glasgow (Reid et al, 1997), although they are considerably lower than those reported by Cox et al (1998). The tool for measurement used by Reid et al (1997) appears to be similar to the one adopted in this study. Reid et al (1997) used a dietary inventory to provide an indication of fruit and vegetable consumption, while Cox et al (1998) used a food frequency questionnaire. The merits and disadvantages of each approach have already been discussed in this thesis (section 5.2.1.2). The decision to use the dietary inventory was informed by the pilot study, where certain social class sub-groups were over-estimating their fruit and vegetable consumption. Given that this over-estimation was not uniform across all social class groups, it was thought preferable to use the inventory method, even though this limited the statistical techniques available which were appropriate to the data. Using the dietary inventory, a more realistic yet conservative estimate of consumption, for this sample, was achieved.

The low levels of fruit and vegetable consumption reported in this research add further support to the emphasis at a policy level on developing strategies to increase fruit and vegetable consumption as a means to better health (SOHHD, 1996; 1993). In order to develop such strategies, an understanding of the target population is essential. Such an understanding would inform decisions as to who should be targeted and the nature of the intervention programmes aimed at the target groups (i.e. the message communicated, the source of the message, the media used, etc.). For this reason, an understanding of the main influences on fruit and vegetable consumption is important.

8.2.2.2. Fruit consumption is different from vegetable consumption

This research has shown that the influences on fruit consumption behaviour are different from those on vegetable consumption. At the qualitative stage of the research, fruit and vegetable consumption were examined simultaneously. Despite this, the qualitative research suggested, and the quantitative stage confirmed, that the behaviours were subject to different groups of influences. It was proposed earlier that food choice was a consequence of the interaction between the individual, the food and the environment. The results of this study clearly show the most important influences, on both fruit and vegetable consumption, to be those classified as relating to the individual. However, for fruit these were more likely to be the socio-demographic characteristics, while for vegetables, the psychological influences, such as motivations in relation to long term health, were more important. Even when the same factors influenced each of fruit and vegetable consumption, the relative importance of the influence varied for each consumption behaviour. Thus, a discussion of each of the separate models of fruit and vegetable consumption follows.

Fruit model

The model of fruit consumption was developed as the result of extensive statistical testing. Early analysis (bivariate) suggested that smoker status was the most important main correlate with fruit consumption, followed by age (where those under 54 had lower fruit consumption). This strong relationship is supported by recent studies exploring aspects of fruit and vegetable consumption (e.g. Anderson et al, 1994; Smith & Smith, 1994). While Smith & Smith (1994) did not focus explicitly on fruit and vegetable consumption, examination of their factor structure of health related behaviour shows smoker status more closely varying with fruit consumption than vegetable consumption. This supports the relationship between smoker status and fruit consumption (but not vegetable consumption) reported here. According to the present study, smoker status is a behaviour that correlates with fruit consumption, but does not necessarily explain fruit consumption. An analysis of the interactions of the socio-demographic and psychological variables, emerging from the logistic regression analysis, gave some interesting insights into fruit consumption, extending the analysis to provide some possible explanations for the behaviour.

There was a strong interaction between smoker status and the psychological variable 'long term motivations', with those who are non-smokers and motivated by long term health likely to be higher fruit consumers. It may be that those motivated by long term health motivations engage in various health related behaviours, of which fruit consumption and non-smoking are two. This may be a plausible explanation as to why smoker status appears as a significant predictor of fruit consumption. It would therefore appear that the main (important) factor influencing fruit consumption is not the smoker status, as previously thought, but 'long term motivation' construct, and that the socio-demographic variable, smoker status, is mediated through the attitude pertaining to long term health. This is compatible with the argument presented by Shepherd & Sparks (1994) that the effects of socio-demographic variables on consumption behaviour are mediated through attitudes. Further, Becker (1974) believed that individuals act in a way consistent with the value they place on health, which may explain the tendency for non-smokers to eat fruit, as observed in this study.

The main effects of place and social class were weak in predicting fruit consumption, although those in Glasgow and the manual social class group tended towards lower fruit consumption. While this is supported by most of the literature examining class and place variations in fruit consumption (e.g. Leather, 1995; Shepherd, et al, 1996; MAFF, 1994, 1995, 1996; Forsyth et al,1994; Anderson et al, 1994), neither place nor social class, *in isolation*, were significant predictors of fruit consumption in the present study.

The interaction effects, revealed by the log linear and logistic regression analyses, showed a shift in importance of the socio-demographic variables, place and social class. Place in particular had a greater impact on fruit consumption in interaction with the other variables. In isolation, place is not a great predictor of fruit consumption, but in combination with other socio-demographic variables, its importance increases. This implies that the socio-demographic factors influencing fruit consumption are closely linked together, and that geographical differences in fruit consumption are symptomatic of a combination of social circumstances, not any one individual factor. These issues are discussed in more detail under Section 8.4.

Of the psychological variables influencing fruit consumption, those captured by the 'longer term motivations' term, such as health beliefs, were very strong in influencing fruit consumption. When these beliefs were not considered important to the individual, consumption was lower. Health beliefs have been shown elsewhere to be an important influence on fruit and vegetable consumption (Goode et al, 1996; Dittus et al, 1995). As well as the health beliefs associated with fruit consumption, the 'long term motivations' construct embodies the items from the Theory of Planned Behaviour measuring subjective norm and behavioural intention.

Interesting theoretical questions are raised by the relationship of fruit consumption to the 'longer term motivation' factor. The only significant psychological influence on fruit consumption was that factor representing long term motivation. This construct included the measures associated with the Theory of Planned Behaviour, i.e. a measure of each of subjective norm and behavioural intention. It would appear then that this theory is appropriate for explaining fruit consumption. The subjective norm construct included normative beliefs (i.e. the beliefs of others) as an important influence on behaviour. It would be reasonable to expect other factors measuring normative beliefs to be important influences on fruit consumption. An example of such a factor would be that embodying the family as an influence on fruit consumption. However, there was inconsistent evidence to support the family's normative influence on fruit consumption, in the current study. The family was a relatively important influence at the qualitative stage of the research, but did not emerge as a significant influence on fruit consumption at the quantitative modelling stage.

Normative influences on behaviour need not only be those relating to the family; friends, colleagues and the media can also represent significant others influencing consumption. The quantitative modelling suggested that normative beliefs were not as important in influencing fruit consumption as the other factors embodied within the 'long term motivations' factor, i.e. behavioural intention and long term health beliefs. This contradiction may stem from individuals rationalising the causes of their behaviour inappropriately in the qualitative stage of the research, or may be attributable to the questionnaire tool not discriminating between specific types of normative influences.

A discussion and consideration of these motivations in terms of goals provides further insights into fruit consumption. Pieters et al (1995) describe goal structures as consisting of a focal goal (*what* the individual is trying to do), with super-ordinate goals providing the *why* and sub-ordinate goals the *how*. The goal structure approach implies a hierarchy: the sub-ordinate goals have to be attained in order to reach higher level goals. 'Long term health' relates to the higher level, or super-ordinate, goal associated with fruit consumption. While this provides information as to the higher level motivation, it does not assist in providing information about the constraints and facilitators of the behaviour. As discussed earlier, goals can have different levels of importance for individuals (Bagozzi, 1993). To analyse the sub-ordinate goals influencing fruit consumption a second model was developed of only those with a positive behavioural intention to consume more fruit. With the emphasis on factors intervening between behavioural intention and action, some insights were provided concerning how fruit is consumed, and thus the facilitators and constraints on this behaviour.

From this second discriminant model, the goal 'hedonic' influences emerged as very important. For fruit consumption, 'hedonic' influences represents a sub-ordinate goal. The literature review discussed a recent emphasis in consumer behaviour research on understanding hedonic consumption. Researchers in this area believe that often a consumer's actions can be explained by the satisfaction of more affect- or pleasure-dominated motivations (e.g. Hirschman & Holbrook, 1982). There are clearly pleasurable, hedonic, aspects to food choice, and it was anticipated these may influence fruit and vegetable consumption. However, there has not been much support for this finding in studies focusing on fruit consumption, of food choice generally. This model suggests that, for individuals with a commitment to eat more fruit, the sub-ordinate goal, 'hedonic' motivations, is important. The long term goal, represented by long term health belief, is still of importance, but overshadowed by the 'hedonic' goal in terms of importance.

Satisfaction of hedonic motivations associated with fruit consumption is the most important constraint on those motivated to increase their fruit consumption. Examining fruit consumption as a goal directed behaviour provides insights into the influences on behaviour at an explanatory level that improves understanding of the specific concerns of those committed to engaging in the behaviour, e.g. eating more fruit. The Goal Directed Behaviour approach appears to provide a useful explanation of fruit consumption.

Vegetable model

Vegetable consumption was modelled in a similar way to fruit consumption. The vegetable model illustrates the differences in types of influence on vegetable and fruit consumption behaviour. While the socio-demographic variables were important influences on fruit consumption, this was not the case for vegetable consumption. Only one socio-demographic variable (age) was an important predictor of vegetable consumption. Age, as an influence on vegetable consumption, may reflect recent trends in eating habits, generally moving away from traditional forms, towards more fast food (Ritson & Hutchins, 1990). This variation in vegetable consumption by age group reflects the patterns in vegetable consumption shown in National Food Survey data (MAFF, 1996). The bivariate analysis suggested that social class and age both had a stronger influence on vegetable consumption than other variables, but this was still fairly weak. Of the socio-economic sub-groups, manual social class participants and those under 34 were likely to be low consumers. Consistently, the analyses showed that socio-demographic variables had a weak influence on consumption. Overall, the socio-demographic variables which influence fruit consumption are not as apparent with vegetables (i.e. smoker status, place and class are not main influences).

The psychological variables had a much greater impact on vegetable consumption. 'Hedonic' motivations (i.e. relating to emotional aspect such as comfort and mood, general interest provided by the food, variety of textures and flavour) were important influences on vegetable consumption. Those who were motivated by 'hedonic' goals tended to have greater consumption of vegetables, suggesting they believe vegetables satisfy their hedonic motivations. Studies focusing on children's vegetable consumption have shown similar 'hedonic' properties of vegetables to be important to acceptance and thus consumption (e.g. Baxter et al, 1997, 1998; Baranowski et al, 1995), but there is no other evidence of this within the area of adult vegetable choice. While hedonic consumption has been explored in the consumer behaviour literature, its focus has been on fun or leisure pursuits (Prentice, 1996; Hirschman and Holbrook, 1982). These findings suggest it would be usefully included in studies of food choice where, to date, the impact of experiential or hedonic factors is relatively unexplored territory.

As with the model for fruit consumption, 'longer term motivation' was a fairly important factor variable in distinguishing between high and low consumers of vegetables. From the earlier bivariate analysis, both the subjective norm and the health belief item significantly influenced vegetable consumption. However, the factor structure (Table 5.14) shows the health beliefs made a greater contribution to this factor than the subjective norm measure, suggesting the Theory of Planned Behaviour (within which normative beliefs are featured) may have limited application for vegetable consumption.

The factor capturing 'convenience' associated with vegetables was an important predictor of vegetable consumption. Those who believed vegetables to be convenient had lower vegetable consumption. This is unexpected; Drewnowski (1996) suggested that versatility and perceived convenience were very closely associated with preferences for vegetables, and Keynote (1993) further reported that vegetables which were perceived as convenient were most popular. It could be argued that those individuals who consumed vegetables fairly regularly (i.e. those classified as high consumers) had a more realistic understanding of the amount of preparation associated with vegetables due to their higher consumption.

The interaction of smoker status with 'long term motivations' and 'hedonic motivations' was a fairly strong influence on vegetable consumption. For non-smokers with a strong motivation in terms of 'longer term motivations' and 'hedonics', higher vegetable consumption followed. In terms of the goal structure for vegetable consumption, it appears that sub-ordinate goals are more important than the super-ordinate goals in influencing the focal goal. While 'long term health' is undoubtedly a super-ordinate goal, and 'convenience' is a sub-ordinate goal (as it clearly relates to the *how* of behaviour), the nature of the 'hedonic' factor is not as clear. 'Hedonic' motivations represented a sub-ordinate goal for fruit consumption, since it influenced the process from behavioural intention to behaviour. However, for vegetable consumption, 'hedonic' motivation is a super-ordinate goal, providing insights into why consumption does or does not occur. Satisfaction of 'hedonic' motivations is very important in influencing vegetable consumption.

The vegetable consumption model was developed for the total sample, and then for those motivated to eat more vegetables. These two models were very similar overall. The first model showed 'convenience' to be the most important, followed by 'hedonics', 'long term motivations' and age. The model developed for those committed to eating more vegetables showed 'family' influences to be very important in constraining consumption. While an individual was motivated to eat more vegetables, the choices made were in the context of the family's tastes and preferences, which acted as an impediment to increased vegetable consumption. The influence of the family on vegetable consumption acts at the sub-ordinate level, since this intervenes between behavioural intention formation and action. The work of Kerr & Charles (1986) suggested general food choices were influenced by family members' preferences. Marshall et al (1995) supported this showing family members' preferences took precedence over the 'good of the family' where fruit and vegetables were concerned. This contributes to explaining the finding from the present study, which shows the family only to be an important influence when the individual is motivated to consume more vegetables. Conflicting family tastes, and efforts to satisfy those tastes, appear to constrain increased vegetable consumption.

8.3 Implications for strategies to increase fruit and vegetable consumption

Using the models developed in this study of fruit and vegetable consumption, and the preceding discussion, there appear to be several strategies which may assist in increasing fruit and vegetable consumption.

Variation in fruit consumption is mainly in terms of the socio-demographic variables. Of the motivational factors influencing fruit consumption, those relating to 'longer term motivations' were the only significant predictor of fruit consumption, i.e. lower fruit consumers were less likely to be motivated by motivations pertaining to long term health. However, for those committed to consuming more fruit, the hedonic influence became important, reflecting satisfaction (emotional and sensory) associated with the behaviour.

These findings form the basis of recommendations for strategies to increase fruit consumption. The emphasis for strategies to increase fruit consumption should be on accessing the target groups, rather than sophisticated messages to reflect their (the target groups) particular issues, concerns, motivations and goals. Language used, cultural aspects, as well as distribution of message are all important issues here. A highly targeted approach is required to improve fruit consumption, focusing on very specific social sub-groups, by area, social class, age and smoker status. Alternatively, an approach targeted at smokers only may be effective, but more research is required to establish the precise nature of and background to differences between smokers and non-smokers in their fruit consumption behaviour.

Any message adopted in a campaign to encourage fruit consumption in the first instance should focus on the 'eat fruit for health' message. Campaigns directed at increasing fruit consumption amongst those who are trying to consume fruit already, or at the ready for action/action stages of the Stage of Change model (Prochaska and DiClemente, 1986), would be better advised to emphasise the hedonic satisfaction provided by fruit.

For vegetable consumption, the socio-demographic variables were not important predictors of vegetable consumption. The approach for increasing vegetable consumption needs to reflect the different goals associated with behaviour. Of these, 'convenience' was the best predictor of vegetable consumption, as was satisfaction of hedonic goals. The only socio-demographic variable of importance was age. The model for all vegetable consumption and those motivated to eat more vegetables were very similar, apart from the importance of the family for those trying to eat more vegetables.

These findings suggest that promotion of vegetables requires strategies which embrace the different goals associated with vegetable consumption. Lower vegetable consumers thought vegetables were convenient, explained either by their misperception of the qualities of vegetables or by their more frequent exposure to vegetables in frozen or canned form, generally more convenient. The other relevant goal for vegetable consumption was satisfaction of hedonic motivations. Lower vegetable consumers did not believe that vegetables satisfied hedonic motivations.

While 'hedonic' motivations represented a higher level goal, more readily addressed, by those interested in increasing vegetable consumption, is the 'convenience' goal. This is because 'convenience' represented a sub-ordinate or lower level goal, which relates to the *how* of vegetable consumption. Lower level goals must be met before higher level goals are satisfied (Pieters et al, 1995).

To encourage low consumers to eat vegetables it is important that the message that vegetables are convenient and satisfy hedonic aspects of consumption is promoted. Support for this message needs to be in place at a retail level, suggesting collaboration between health promoting bodies, suppliers and retailers is essential to the success of any attempt to increase vegetable consumption. It is important that retailers make available tasty vegetable dishes, innovative recipes and other in-store information emphasising convenience.

To encourage increased vegetable consumption among those who are trying to do so, the role of the family and strategies to incorporate their varying tastes need to be devised. This could be in the form of skills provision, with the aim of providing convenient and fairly easy ways of serving vegetables to appeal to a range of tastes. This might assist in overcoming this constraint on increased vegetable consumption.

Given that age is the only important socio-demographic characteristic showing in vegetables consumption, focusing on such demographics as a way of targeting messages for increased vegetable consumption is probably not very useful. However, there may be opportunities to increase vegetable consumption among the younger age group, focusing on issues relevant to this age group and drawing on the sub-cultural symbols associated with 'youth culture'.

The adoption and implementation of some of the suggested practical strategies, which are in accordance with the findings from this research, could provide opportunities for health promoters to improve fruit and vegetable consumption.

8.4 Role of place

A recurring theme throughout this thesis has been the examination of place as a key influence on fruit and vegetable consumption. This was informed by the distinct regional variations in fruit and vegetable consumption in the UK (MAFF, 1996, 1995, 1994; Gregory et al, 1989).

The qualitative stage in the research suggested that there were some differences between the selected areas in their fruit and vegetable consumption, mainly reflected in the marketing or shopping related variables. However, these differences were not statistically significant in the quantitative stage of the research. Insights into the non-significance of this set of variables may be found by further exploring the role of place in consumption.

A significant constituent of the term 'place', in the context of this research, is the retail geography which facilitates consumption (Lowe & Wrigley, 1996). Consumers are influenced in what they buy by what is available to them (Bareham, 1995). Dawson (1995), writing about retail trends in Scotland, suggests that retail provision is greatly influenced by local circumstances of the place, including the economic base of the place. In addition, Crang (1996) suggest a 'displacement' view of consumption, i.e. focusing on movements to, from and between points of consumption. In this view, place of consumption is not static, and the focus is on the cultural and historical factors which have brought an individual to a consumption situation. Both these views suggest that place is a surrogate indicator for a host of variables interacting to influence consumption, and this is supported by Massey (1995) who believes place to be the locus of intersecting social relations.

Further support for this perspective on retail geography is found in a recent study of fruit and vegetable retailing and consumption in Glasgow (Reid et al, 1997). Examining fruit and vegetable retailing systems of two socially contrasting neighbourhoods, the researchers found fruit and vegetable retailing to be similar in the two areas, as well as the reported levels of consumption. While there are social class differences between these areas, they are very similar in the supply and consumption of fruit and vegetables. The authors conclude that historical and cultural factors are embodied in 'place', and an examination of these may explain regional variations in fruit and vegetable consumption (Reid et al, 1997). This follows Crang's view that the focus for explanation of consumption would usefully be on the influences that brought an individual to a situation, their background, and how it influences current consumption patterns.

In the present study, the cultural aspects of place were found to be very important in the qualitative stage of the research (Section 4.5.2.1). The quantitative findings, however, showed place to be fairly important, but so too were other factors. The emergence of these issues as very important from the qualitative study, but only slightly important from the quantitative stage, has two implications. First, it is evident that further research is required which focuses on cultural and historical aspects of fruit and vegetable consumption, both generally and with regard to the Scottish context. Secondly, it may be the case that quantitative methods, with their emphasis on causal relationships, are insensitive instruments for the elucidation of cultural processes and phenomena. Other studies considering the influence of place on consumption tend to adopt qualitative methods. An example is provided in Jackson & Holbrook's (1995) qualitative study, where two neighbouring shopping centres were compared, and issues related to culture, shopping and identity were explored. Their findings showed the rich insights into shopping behaviour that emerge when a qualitative approach was adopted.

8.5 Some reflections and criticisms

At this point, it is worthwhile reflecting on the limitations of the study. This discussion mirrors the stages of the research.

From the analysis of the literature, a decision was made to adopt an inductive approach to modelling fruit and vegetable consumption. Some constructs from the Theory of Planned Behaviour and the general framework of the Theory of Goal Directed Behaviour were included and used in the interpretation of the findings. This discussion of the results in terms of these theories showed both theories to be relevant, to varying degrees, in explaining fruit and vegetable consumption. Formal use of these theoretical frameworks for examining fruit and vegetable consumption may have been useful, and forms the basis of one of the recommendations for future research (Section 8.6).

There are methodological problems and issues associated with the main stages of data collection. The first relates to the focus groups conducted to inform the questionnaire (which was used to develop the model). These focus groups were conducted with women only, although questions were included to explore men and children's fruit and vegetable consumption habits. As discussed in Chapter 4, this did not appear to be a major problem with the final results, and there were no significant differences in the patterns of response for males and females.

The second concern relates to the validity of the questionnaire tool in measuring the influences on fruit and vegetable consumption. The items included to measure the psychological influences on fruit and vegetable consumption were developed from the literature review and qualitative stage of the study. Measurement of the variables influencing fruit and vegetable consumption was the same for each behaviour. While the reliability of the individual items measuring the psychological influences on fruit and vegetable consumption was not assessed, the reliability of the factor structure (of the relationship between these variables) was established. It was these factor variables which were included in the models of fruit and vegetable consumption. Significant differences emerged between the models of each behaviour, in terms of the factor variables, suggesting unreliability associated with the measurement of constructs (i.e. the questionnaire) does not provide a sufficient explanation for differences in fruit and vegetable consumption.

A limitation associated with the modelling approach used in this study was the sample size achieved (390 in total). With a smaller Bristol sample, and a greater proportion of lower fruit and vegetable consumers than higher consumers, there was a danger of overfitting contingency based models. Over-fitted models are those where there are only a few members meeting the conditions for each cell, providing a spurious representation of what is happening in reality. The implication is that interpretation of the change in likelihood of fruit and vegetable consumption as a consequence of changing socio-demographic condition must be with caution. Referring back to Table 6.18, there are some rather extreme results presented, e.g. the change in condition from 'Bristol, non-manual, <34, smoker' to 'Glasgow, non-manual, <34, smoker' increases the odds of low consumption by 373 times. While these results have contentious face validity, a prudent approach would be to use the log linear analysis as a basis for the other analysis, i.e. to suggest the underlying structure among variables, rather than taking the absolute values as a precise representation of reality. In the current work, the log linear analysis provided an understanding of the structure of the interaction between the socio-demographic variables. This was used to inform the structure of the models developed in the logistic regression and discriminant analysis.

The final, related, concern lies with the statistical techniques employed for development of the models of fruit and vegetable consumption. These models were developed using non-parametric techniques. Other studies of food choice use the more familiar multiple regression or logistic regression. The technique chosen depends largely on the nature of the dependent variable on which the modelling is based. A valid, continuous measure of fruit and vegetable consumption would have been ideal, which might have been achieved using a food frequency questionnaire (FFQ), the diary method or a weighed intake. In section 5.1.2.2, the pilot of the FFQ was discussed and the problems raised, i.e. those in the lower socio-economic groups were consistently over-estimating consumption levels, but not by a uniform displacement. Such over-estimation would be problematic insofar as the models developed would be based on inaccurate data. The rejection of this approach to measuring food consumption in favour of the less powerful food inventory method was based on careful thought and consideration given to the implications in terms of the statistical methods then available. On balance, it was considered preferable to have improved reliability of the dependent variable, although this meant decreased power of statistics available. However, it was also for this reason that thorough statistical analysis was conducted, i.e. the log linear modelling followed by the logistic regression and then the discriminant models.

8.6 Future research directions

This study represents an important stage in developing models of fruit and vegetable consumption, and as a preliminary to informing strategies to increase consumption. The study also represents some important developments in the study of food choice theory in general. A number of different research directions could be considered; a few are outlined below.

The research worked on the basis of the development of models of fruit and vegetable consumption, grounded in consumers' knowledge, attitudes and motivations towards fruit and vegetables. As such, the models developed in this study can be viewed as propositions to be tested elsewhere. Research, testing the models of the Theory of Planned Behaviour and Theory of Goal Directed Behaviour in the specific applications of fruit and vegetable consumption, may verify some of the findings from this study, and explore further the relevance of such models to explaining fruit and/or vegetable consumption. Further, such testing would confirm the speculations of this study in relation to the suitability of attitudinal and goal directed models for explaining food choice behaviour.

Historical and cultural aspects of diet appear to be important in explaining differences, and this may be an enlightening direction for further study of fruit and vegetable consumption behaviour. A supplementary line of research is in the area of experiential and hedonic aspects of consumption. Further research is required which focuses on the role of culture and history in influencing consumption of fruit and vegetables. Attempts to incorporate hedonic, including symbolic and experiential measures, into the existing attitudinal models, would also be potentially very useful for food choice theory in general.

Specifically for fruit and vegetable consumption, a case study approach may be implemented, within a community, where more detailed explanations for differences in fruit and vegetable consumption are sought. Some of the strategies to increase fruit and vegetable consumption could be implemented, monitored and evaluated in terms of the longer term impact on their consumption levels. This could take the form of advertising research, as well as co-operation with retailers to implement some of the findings.

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Appendix 1 Focus Group Discussion Guide

Introduction to topic of discussion

Frequently we are told that we should be eating more healthy foods. We hear about this on TV, in the newspapers and on advertisements in the street. What we are here to talk about today is healthy eating - how we feel about it, what or who influences our choice of foods, and what kind of things would make it easier to eat more healthily.

Everybody's thoughts and experiences are interesting and valuable, since I'm here to learn from you. Feel free to say whatever you think on the subject (even if you disagree with someone else) - basically, I want to hear as many different stories and experiences as possible.

These 3 things will make the discussion easier:

1. Only one person speak at a time, and others try to listen
2. Avoid side conversations with neighbours, as it is distracting
3. Everyone participate, and say something.

Opening statements/Ice breaker

Everyone introduce themselves and say one food they associate with healthy eating

Topic 1 Healthy eating

What is healthy eating? (based on first pieces of inf. and anything new)

What are the benefits of healthy eating?

How do you feel about healthy eating....?

do you have a healthy diet?

what/who affects you choice of foods?

what problems/difficulties do you face in eating healthily?

Topic 2 Fruit and vegetable consumption

What do you think is the right amount of F&V to eat each day? each week?

Do you manage this?

What is it about F&V you like/dislike?

Who/what influences you to eat F&V?

What influence does your family's tastes have on whether F&V is eaten or not?

Uncued question: What difficulties/problems do you face in trying to eat F&V?

Cued question: Things I've thought of which might affect F&VI include cooking skills/knowledge, storage space in the fridge, personal taste. Can you think of other things?

On balance, what do you think is the most important thing (factor) affecting whether or not you eat F&V?

What do you think would make it easier for you to eat more F&V?

Topic 3 Fruit and vegetable buying behaviour

[Where do you buy F&V? How frequently?]

What influences you in buying F&V?

What puts you off buying F&V?

Again, I've tried to think of things which might affect whether or not you buy fruit and veg. Some things I've thought of are price, price compared to other foods (substitutes), area you live in ......

What do you think of these things? Can you think of any others?

Appendix 2 Demographic questionnaire for focus group discussions

Please tick relevant boxes::

AGE GROUP:

18 - 24

25 - 34

35 - 44

45 - 54

55 - over

Occupation:

Occupation of spouse / partner:

Do you have any children? Yes If yes, how many?__________

No

Appendix 3 Codes for focus groups analysis

L	Like
M	Moderation
U	uncertainty
C	Confusion, confused message
D-H	diet and effect on health
Info	source of info on healthy eating
F	Financial considerations
Cv	Convenience
R	Retailing
Cx	Context
En	Environmental, climatic factors - conducive to non-consumption
WE	Weekend structure compared to working day
Alt	Alternative to a healthy diet
Fam	Family influences
T	Time
Chi	Children
SP	Social pressure
Fcure	Food as a cure for illness
Fpr	Food preventing illness
Pr	Preferences, tastes
Q	Quality of fruit and veg
Ck	Issues relating to cooking
Per	Perceptions
Var	Variety in diet
Trad	Tradition
Sat	Satiety
Di	Diet
Hp	Food for pleasure, hedonics, stability
Pte	Eating patterns
Pt	Meal patterns/structure

Heff	Efforts to improve healthiness
Ing	Ingredients
Govt	Government intervention/involvement
Place	Cultural aspects contributing to differences in health - shopping around
BD	Benefits of f&v consumption to overall health
Ch	Choice between healthy and unhealthy
Eff	Effectiveness of campaigns for healthy eating
Fz	Freezers, frozen foods
Nal	Nutritional awareness
Mw	Use of microwave
Form	Form of food, i.e. fresh vs frozen vs tinned
Lf	Lifestyle
Fat	Fat awareness in foods
Age	Specific age groups mentioned (e.g. elderly)
Prep	Preparation, prepare
Trad	Tradition (in cooking)
Gro	Fresh grown fruit and veg
Use	What you use it for
Org	Organic foods
W	waste
Tr	Treat

Appendix 4 Items in questionnaire

Category of variable	Construct/ variable	QUESTION/STATEMENT	*dimensions of judgement*	*measure (type of data)*
External	Family - others' tastes	My spouse/partner likes them My children like them	s. agree - s. disagree	ordinal
External	Family - Responsibility for dietary habits	They are healthy for my family	s. agree - s. disagree	ordinal
External	Family - set example	It sets a good example for my family	s. agree - s. disagree	ordinal
External	Family - acceptability of f/v by family (not force)	F/v are accepted by other members of my family	s. agree - s. disagree	ordinal
External	Family - Breakdown of family meal -- fast food in home	It is difficult to eat f/v in my house, because we all eat different meals at different times	s. agree - s. disagree	ordinal
External	Meal structure - tradition	F/v are easily eaten as part of the traditional 'meat and 2 veg' meal	s. agree - s. disagree	ordinal
External	Meal structure - snacking	F/v are good snacks	s. agree - s. disagree	ordinal
External	Family - Fill family	F/v fill my family	s. agree - s. disagree	ordinal
External	Place	What is your postcode	open - code to categories	categoric al
External	Meal structures - context of consumption	How likely would you be to eat f/v at each of the following situations?	ex. likely to ex. unlikely	ordinal
External	family influences	How many other members in your family (family composition) ?	category?	categoric al
External	Subjective norms	Those important to me think eating f/v is a good thing	s. agree - s. disagree	ordinal
Internal	Personal resources - time / organisation	f/v are time -consuming		
Internal	Sex	Male/female	y/n	categoric al
internal	Smoker status	Do you smoke?	y/n	categoric al
Internal	Personal resources - money	f/v are too expensive		
Internal	Health beliefs: protective effects of f/v.	The foods I eat now can protect my against ill-health in the future	s. agree - s. disagree	ordinal
Internal	Ability: Cooking skills	I can think of different ways of preparing /cooking veg	s. agree - s. disagree	ordinal

Category of variable	Construct/ variable	STATEMENT	*dimensions of judgement*	*measure (type of data)*
Internal	Attitudes and beliefs in relation to health	I think eating more f/v can have a positive effect on my health I feel confused about what foods are healthy and what foods are unhealthy	s. agree - s. disagree	ordinal
Internal	Beliefs - everything in moderation	I believe a healthy diet is everything in moderation	s. agree - s. disagree	ordinal
Internal	Long term motivation - health - health related	It keeps me healthy	s. agree - s. disagree	ordinal
Internal	Motivations: Appearance	It improves my overall appearance	s. agree - s. disagree	ordinal
Internal	Motivations Slimming	It helps me to lose weight	s. agree - s. disagree	ordinal
Internal	Motivations Weight maintenance	It helps me to maintain my weight	s. agree - s. disagree	ordinal
Internal	Motivations Skin	it is good for my skin	s. agree - s. disagree	ordinal
Internal	Motivations: Hedonic	It reminds me of other nice occasions It puts me in a good mood	s. agree - s. disagree	ordinal
Internal	Hedonic motivation: - texture, flavour, interest	I find them very interesting I like the variety of textures available I like the variety of flavours available	s. agree - s. disagree	ordinal
Internal	Hedonic motivation: tastes	Variety of tastes with f/v	s. agree - s. disagree	ordinal
Internal	Hedonic motivation: Comforting foods	it is comforting to eat	s. agree - s. disagree	ordinal
Internal	Hedonic motivation: Feel good	It makes me feel good	s. agree - s. disagree	ordinal
Internal	Hedonic motivation Boring/exciting	I find them boring	s. agree - s. disagree	ordinal
Internal	Physiological consequences	F/v are too bulky	s. agree - s. disagree	ordinal
Internal/external	Socio-economic status	What is your occupation?	occupation	categorical
Marketing	Product - Risk of waste	There is a lot of waste when you prepare f/v	s. agree - s. disagree	ordinal
Marketing	Product -- time to cook	F/v take a long time to prepare	s. agree - s. disagree	ordinal

Category of variable	Construct/ variable	QUESTION/STATEMENT	*dimensions of judgement*	*measure (type of data)*
Marketing	Availability - time/effort to shop for	f/v/ take a long time to shop for F/v are difficult to shop for	s. agree - s. disagree	ordinal
Marketing	Availability - variety	How would you rate the variety of f/v available where you live?	ex. good - ex. bad	ordinal
Marketing	Availability: distance travelled	How far do you travel to buy f/v	ordinal	ordinal
Marketing	Availability - retail outlet	where do you buy f/v	categorical	categorical
Marketing	Product - acceptability of different product forms	How acceptable would you say frozen veg are as an alternative to fresh? same for 'fruit' and 'tinned'	h. acceptable - h. unacceptable.	ordinal
Marketing	Product - versatility	How versatile would you say f/v are ?	extremely. versatile - extremely. unversatile.	ordinal
Marketing	Product - Heavy to carry	They are not heavy to carry	s. agree - s. disagree	ordinal
Marketing	Product - Inconvenient/messy	They are not messy	s. agree - s. disagree	ordinal
Marketing	Product - Preparation required	They require little or no prep.	s. agree - s. disagree	ordinal
Marketing	Product - Easily disguised	They are easily disguised	s. agree - s. disagree	ordinal
Marketing	Product - Appearance as a measure of quality	They look like good quality	s. agree - s. disagree	ordinal
Marketing	Product - Taste as a measure of quality	The taste is good	s. agree - s. disagree	ordinal
Marketing	Product - Frozen vs. fresh	The quality of frozen veg is as good as the quality of fresh Same for tinned	s. agree - s. disagree	ordinal
Marketing	Price - F&V perceived as expensive	F/v are expensive	s. agree - s. disagree	ordinal
Marketing	Distribution/availability - Quality available	The quality of f/v/ available where I live is good	s. agree - s. disagree	ordinal
Marketing	Distribution/availability - Variety available	The variety of f/v/ available where I live is good	s. agree - s. disagree	ordinal
Marketing	Product: Convenience	They are convenient to eat	s. agree - s. disagree	ordinal

Appendix 5 Pilot questionnaire

Introduction

As a researcher at Queen Margaret College, I am interested in the food choices people make.

These questions are related to your shopping habits and opinions concerning food generally, and about fruit and vegetables specifically. The later part of the questionnaire asks about how much fruit and vegetables you typically eat.

Your answers are important to us - we need to know how you really feel about fruit and vegetables, and also how much you eat. Because it is important that you give some time to these questions, we are leaving the questionnaire with you, for you to fill in at a convenient time. The interviewer will pick it up at a time that suits you.

The contents of this form are ***absolutely confidential.*** Information identifying the respondent will not be disclosed under any circumstances.

The questionnaire will take about 30 minutes to fill in. Please take your time and make sure all questions are answered. If you have any questions or difficulties, the interviewer will be happy to help you at the collection time.

Thank you for your help,

Maria Piacentini
Dept. of Applied Consumer Studies,
Queen Margaret College,
Clerwood Terrace,
Edinburgh,
EH12 8TS.

A. Shopping and use of fruit and vegetables

Please read the following questions and tick the appropriate box.

1. Who PLANS meals for your household?
   - You ☐
   - Your spouse/partner ☐
   - Both of you ☐
   - Other - please specify ☐

2. Who SHOPS for food for your household?
   - You ☐
   - Your spouse/partner ☐
   - Both of you ☐
   - Other - please specify ☐

3. Who PREPARES/COOKS meals for your household?
   - You ☐
   - Your spouse/partner ☐
   - Both of you ☐
   - Other - please specify ☐

4. a) Where do you normally buy fruit?
   - Supermarket ☐ Home grown ☐
   - Market ☐ Other ☐
   - Greengrocers ☐

   b) Where do you normally buy vegetables?
   - Supermarket ☐ Home grown ☐
   - Market ☐ Other ☐
   - Greengrocers ☐

5. a) How far do you normally travel to buy fruit?
   - < 1 mile ☐ 6 - 10 miles ☐
   - 1.1 - 3 miles ☐ > 10 miles ☐
   - 3.1 - 5 miles ☐

   b) How far do you normally travel to buy vegetables?
   - < 1 mile ☐ 6 - 10 miles ☐
   - 1.1 - 3 miles ☐ > 10 miles ☐
   - 3.1 - 5 miles ☐

6. a) How do you normally travel to buy fruit?
   - walk ☐ taxi ☐
   - bus ☐ train ☐
   - car ☐ underground ☐
   - other ☐

   b) How do you normally travel to buy vegetables?
   - walk ☐ taxi ☐
   - bus ☐ train ☐
   - car ☐ underground ☐
   - other ☐

	Extremely poor						Extremely good
7. a) How would you rate the variety of fruit available in the area where you live?	☐	☐	☐	☐	☐	☐	☐
b) How would you rate the variety of vegetables available in the area where you live?	☐	☐	☐	☐	☐	☐	☐

	Extremely unacceptable						Extremely acceptable
8. a) How acceptable would you say frozen vegetables are as an alternative to fresh?	☐	☐	☐	☐	☐	☐	☐
b) How acceptable would you say tinned vegetables are as an alternative to fresh?	☐	☐	☐	☐	☐	☐	☐

	Extremely unversatile						Extremely versatile
9. a) How versatile would you say fruit is?	☐	☐	☐	☐	☐	☐	☐
b) How versatile would you say vegetables are?	☐	☐	☐	☐	☐	☐	☐

10. How likely would you be to eat fruit (including dried fruit) as part of each of the following meals?

	Highly unlikely						Highly likely
Breakfast	☐	☐	☐	☐	☐	☐	☐
Mid-morning snack	☐	☐	☐	☐	☐	☐	☐
Lunch	☐	☐	☐	☐	☐	☐	☐
Afternoon snack	☐	☐	☐	☐	☐	☐	☐
Evening meal	☐	☐	☐	☐	☐	☐	☐
Evening snack/supper	☐	☐	☐	☐	☐	☐	☐
Late evening snack	☐	☐	☐	☐	☐	☐	☐

11. How likely would you be to eat vegetables as part of each of the following meals?

	Highly unlikely						Highly likely
Breakfast	☐	☐	☐	☐	☐	☐	☐
Mid-morning snack	☐	☐	☐	☐	☐	☐	☐
Lunch	☐	☐	☐	☐	☐	☐	☐
Afternoon snack	☐	☐	☐	☐	☐	☐	☐
Evening meal	☐	☐	☐	☐	☐	☐	☐
Evening snack/supper	☐	☐	☐	☐	☐	☐	☐
Late evening snack	☐	☐	☐	☐	☐	☐	☐

B. Food Choice

These questions are to do with your personal choices relating to eating foods generally. Read each of these statements. Please indicate how much you DISAGREE or AGREE with each of them on a scale of 1 (strongly disagree) to 7 (strongly agree).

Generally, it is important to me when I am choosing FOOD that:

	Strongly disagree	Quite disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Quite agree	Strongly agree
It looks like good quality	☐	☐	☐	☐	☐	☐	☐
It tastes good	☐	☐	☐	☐	☐	☐	☐
It is NOT messy	☐	☐	☐	☐	☐	☐	☐
It is NOT heavy to carry	☐	☐	☐	☐	☐	☐	☐
My spouse/partner likes it	☐	☐	☐	☐	☐	☐	☐
My children like it	☐	☐	☐	☐	☐	☐	☐
It is healthy for my family	☐	☐	☐	☐	☐	☐	☐
It sets a good example for my family	☐	☐	☐	☐	☐	☐	☐
It is accepted by other members of my family	☐	☐	☐	☐	☐	☐	☐
It keeps me healthy	☐	☐	☐	☐	☐	☐	☐
It fits in with my eating habits	☐	☐	☐	☐	☐	☐	☐
It improves my overall appearance	☐	☐	☐	☐	☐	☐	☐
It helps me to lose weight	☐	☐	☐	☐	☐	☐	☐
It helps me to maintain my weight	☐	☐	☐	☐	☐	☐	☐
It is good for my skin	☐	☐	☐	☐	☐	☐	☐
It cheers me up	☐	☐	☐	☐	☐	☐	☐
It is interesting	☐	☐	☐	☐	☐	☐	☐
It has a variety of textures	☐	☐	☐	☐	☐	☐	☐
It has a variety of flavours	☐	☐	☐	☐	☐	☐	☐
It is comforting to eat	☐	☐	☐	☐	☐	☐	☐
It is convenient to eat	☐	☐	☐	☐	☐	☐	☐
It fits in with a medically supervised	☐	☐	☐	☐	☐	☐	☐

Specifically, it is important to me when I am choosing FRUIT that:

	Strongly disagree	Quite disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Quite agree	Strongly agree
It looks like good quality	☐	☐	☐	☐	☐	☐	☐
It tastes good	☐	☐	☐	☐	☐	☐	☐
It is NOT messy	☐	☐	☐	☐	☐	☐	☐
It is NOT heavy to carry	☐	☐	☐	☐	☐	☐	☐
My spouse/partner likes it	☐	☐	☐	☐	☐	☐	☐
My children like it	☐	☐	☐	☐	☐	☐	☐
It is healthy for my family	☐	☐	☐	☐	☐	☐	☐
It sets a good example for my family	☐	☐	☐	☐	☐	☐	☐
It is accepted by other members of my family	☐	☐	☐	☐	☐	☐	☐
It keeps me healthy	☐	☐	☐	☐	☐	☐	☐
It fits in with my eating habits	☐	☐	☐	☐	☐	☐	☐
It improves my overall appearance	☐	☐	☐	☐	☐	☐	☐
It helps me to lose weight	☐	☐	☐	☐	☐	☐	☐
It helps me to maintain my weight	☐	☐	☐	☐	☐	☐	☐
It is good for my skin	☐	☐	☐	☐	☐	☐	☐
It cheers me up	☐	☐	☐	☐	☐	☐	☐
It is interesting	☐	☐	☐	☐	☐	☐	☐
It has a variety of textures	☐	☐	☐	☐	☐	☐	☐
It has a variety of flavours	☐	☐	☐	☐	☐	☐	☐
It is comforting to eat	☐	☐	☐	☐	☐	☐	☐
It is convenient to eat	☐	☐	☐	☐	☐	☐	☐
It fits in with a medically supervised diet	☐	☐	☐	☐	☐	☐	☐

Specifically, it is important to me when I am choosing VEGETABLES that:

	Strongly disagree	Quite disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Quite agree	Strongly agree
They look like good quality	☐	☐	☐	☐	☐	☐	☐
They taste good	☐	☐	☐	☐	☐	☐	☐
They are NOT messy	☐	☐	☐	☐	☐	☐	☐
They are NOT heavy to carry	☐	☐	☐	☐	☐	☐	☐
My spouse/partner likes them	☐	☐	☐	☐	☐	☐	☐
My children like them	☐	☐	☐	☐	☐	☐	☐
They are healthy for my family	☐	☐	☐	☐	☐	☐	☐
They set a good example for my family	☐	☐	☐	☐	☐	☐	☐
They are accepted by other members of my family	☐	☐	☐	☐	☐	☐	☐
They keep me healthy	☐	☐	☐	☐	☐	☐	☐
They fit in with my eating habits	☐	☐	☐	☐	☐	☐	☐
They improve my overall appearance	☐	☐	☐	☐	☐	☐	☐
They help me to lose weight	☐	☐	☐	☐	☐	☐	☐
They help me to maintain my weight	☐	☐	☐	☐	☐	☐	☐
They are good for my skin	☐	☐	☐	☐	☐	☐	☐
They cheer me up	☐	☐	☐	☐	☐	☐	☐
They are interesting	☐	☐	☐	☐	☐	☐	☐
They have a variety of textures	☐	☐	☐	☐	☐	☐	☐
They have a variety of flavours	☐	☐	☐	☐	☐	☐	☐
They are comforting to eat	☐	☐	☐	☐	☐	☐	☐
They are convenient to eat	☐	☐	☐	☐	☐	☐	☐
They fit in with a medically supervised diet	☐	☐	☐	☐	☐	☐	☐

C. Food consumption

This section is concerned with the type of fruit and vegetables you eat, and how often you eat them.

1. How often do you eat fruit?

   - more than once per day ☐ ⇒ How many times per day? ___
   - 5-7 times a week ☐
   - 3-4 times a week ☐
   - 1-2 times per week ☐
   - once per month ☐
   - less than once per month /never ☐

2. How often do you eat vegetables?

   - more than once per day ☐ ⇒ How many times per day? ___
   - 5-7 times a week ☐
   - 3-4 times a week ☐
   - 1-2 times per week ☐
   - once per month ☐
   - less than once per month /never ☐

3. How often do you eat these foods listed below? Indicate the number of times each portion size is eaten.

	Portion size	*Per day*	*Per week*	*Per month*	*Per year*	*Rarely or never*
Apple, pear	1	☐	☐	☐	☐	☐
Banana	1	☐	☐	☐	☐	☐
Grapes	a handful	☐	☐	☐	☐	☐
Orange, satsuma, clementine, tangerine	1	☐	☐	☐	☐	☐
Peach, nectarine	1	☐	☐	☐	☐	☐
Softberry fruits (strawberries; blackcurrants; raspberries)	cupful	☐	☐	☐	☐	☐
Plums, kiwi fruit, apricots	2	☐	☐	☐	☐	☐

Please indicate how much you agree or disagree with the following statements about FRUIT

	Strongly disagree	Quite disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Quite agree	Strongly agree
There is a lot of waste when you prepare fruit	☐	☐	☐	☐	☐	☐	☐
Fruit takes a long time to prepare	☐	☐	☐	☐	☐	☐	☐
Fruit takes a long time to shop for	☐	☐	☐	☐	☐	☐	☐
Fruit makes a good snack	☐	☐	☐	☐	☐	☐	☐
Fruit is filling	☐	☐	☐	☐	☐	☐	☐
Fruit is expensive	☐	☐	☐	☐	☐	☐	☐
Fruit is easily available	☐	☐	☐	☐	☐	☐	☐
People who are important to me think eating fruit is a good thing	☐	☐	☐	☐	☐	☐	☐
Eating fruit can protect me against illness later in life	☐	☐	☐	☐	☐	☐	☐
A healthy diet includes everything in moderation	☐	☐	☐	☐	☐	☐	☐
I intend to eat more fruit within the next year	☐	☐	☐	☐	☐	☐	☐

Please indicate how much you agree or disagree with the following statements about VEGETABLE

	Strongly disagree	Quite disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Quite agree	Strongl agree
There is a lot of waste when you prepare vegetables	☐	☐	☐	☐	☐	☐	☐
Vegetables take a long time to prepare	☐	☐	☐	☐	☐	☐	☐
Vegetables take a long time to shop for	☐	☐	☐	☐	☐	☐	☐
Vegetables are good for a snack	☐	☐	☐	☐	☐	☐	☐
Vegetables are filling	☐	☐	☐	☐	☐	☐	☐
Vegetables are expensive	☐	☐	☐	☐	☐	☐	☐
Vegetables are easily available	☐	☐	☐	☐	☐	☐	☐
People who are important to me think eating vegetables is a good thing	☐	☐	☐	☐	☐	☐	☐
Eating vegetables can protect me against illness later in life	☐	☐	☐	☐	☐	☐	☐
I intend to eat more vegetables within the next year	☐	☐	☐	☐	☐	☐	☐

	Portion size	*Per day*	*Per week*	*Per month*	*Per year*	*Rarely or never*
Melon, pineapple, paw paw (papaya)	large slice	☐	☐	☐	☐	☐
Avocado pear	1/2	☐	☐	☐	☐	☐
Guavas	3	☐	☐	☐	☐	☐
Grapefruit	1/2	☐	☐	☐	☐	☐
Dried fruit (e.g. prunes; sultanas;mixed fruit)	1/2 tablespoon	☐	☐	☐	☐	☐
Fruit juice (pure, concentrated or fresh)	1 glass or cup (100ml)	☐	☐	☐	☐	☐
Fruit salad	2 tablespoons	☐	☐	☐	☐	☐
Other fruits - please specify						

	Portion size	*Per day*	*Per week*	*Per month*	*Per year*	*Rarely or never*
Broccoli, brussels sprouts, cabbage, chard, courgette, peas, leek	2 tablespoons	☐	☐	☐	☐	☐
French or runner beans, kale, spinach, mangetout, okra, broadbeans	2 tablespoons	☐	☐	☐	☐	☐
Cauliflower, kohlrabi, squash, pumpkin, sweet potatoes, marrow	2 tablespoons	☐	☐	☐	☐	☐
Lettuce (iceberg)	4 leaves	☐	☐	☐	☐	☐
Other lettuce	8 leaves	☐	☐	☐	☐	☐
Cucumber	5 slices	☐	☐	☐	☐	☐
Tomato	1	☐	☐	☐	☐	☐
Cherry tomatoes	5	☐	☐	☐	☐	☐
Radish, spring onions	3	☐	☐	☐	☐	☐

	Portion size	*Per day*	*Per week*	*Per month*	*Per year*	*Rarely or never*
Beetroot	2 whole or 8 slices	☐	☐	☐	☐	☐
Beansprouts	4 tablespoons	☐	☐	☐	☐	☐
Celery	1 stick	☐	☐	☐	☐	☐
Pepper (red, yellow or green)	1/2	☐	☐	☐	☐	☐
Mustard, cress	1/2 bunch	☐	☐	☐	☐	☐
Carrots, turnip, swede, parsnip, mushrooms, aubergines, swedes	2 tablespoons	☐	☐	☐	☐	☐
Sweetcorn	3 tablespoons	☐	☐	☐	☐	☐
Artichoke	1	☐	☐	☐	☐	☐
Asparagus	4-5 spears	☐	☐	☐	☐	☐
Other - please specify		☐	☐	☐	☐	☐

D. Food Habits

1. Are you vegetarian? ☐ Yes ☐ No

2. a) In your judgement, do you eat the right amount of food to keep you healthy?

   Yes ☐
   No - too little ☐
   No - too much ☐
   Don't know ☐

   b) In your judgement, do you eat the right type of food to keep you healthy?

   Yes ☐
   No ☐

3. How often do you have a breakfast (cooked or uncooked)?

   Every day ☐
   Most days (3-6) ☐
   Less than once a week ☐
   1 or 2 per week ☐
   Never ☐

4. a) How many other main or cooked meals do you usually have (that is a meal that has a main course with 1 or more veg)?

   No. of main meals a day _

   b) How many lighter meals (e.g. sandwiches) do you usually have during the day?

   No. of light meals per day __

5. How often do you have a meal away from home? (light meals or main meals)

   More than once a day ☐
   Once or twice per week ☐
   Once a day ☐
   Less than once per week ☐
   Most days (3-6) ☐
   Never ☐

6. How often do you have a carry out/takeaway meal at home?

   More than once a day ☐
   Once or twice per week ☐
   Once a day ☐
   Less than once per week ☐
   Most days (3-6) ☐
   Never ☐

7. How many times a day do you have a snack or something to eat between meals or before going to bed?

- Once or twice ☐
- 3 or 4 times ☐
- More than 4 times ☐
- Never ☐

8. Do you eat regularly, that is have the same number of meals and snacks at roughly the same time each day?

- Yes ☐
- No ☐
- Varies ☐

E. Personal Details

To help us classify your answers and make some statistical comparisons, we would like you to answer some brief questions about you and your household.

1. Are you? Male ☐ Female ☐

2. Which age group do you belong to?

Aged under 25	☐	55-64	☐
25-34	☐	65-74	☐
35-44	☐	75 and over	☐
45-54	☐		

3. What is your postcode? ☐☐☐☐☐☐☐

4. a) What is your job title? (If retired, please indicate previous title). Please be as specific as possible. ________________

   b) What is your spouse's job title? (If retired, please indicate previous job title). Please be as specific as possible. ________________

5. What is the highest level of qualifications you have achieved?

None	☐	First degree	☐
GCSE or equivalent	☐	Higher degree	☐
Craft/guild/technical	☐	Chartered professional qualification	☐
Apprenticeship	☐		
Higher education - none degree	☐	Other - please specify	☐

6. What was the highest level of qualification your father achieved?

None ☐
GCSE or equivalent ☐
Craft/guild/technical ☐
Apprenticeship ☐
Higher education - none degree ☐
First degree ☐
Higher degree ☐
Chartered professional qualification ☐
Other - please specify ☐

7. What was your father's occupation when you were aged 10? ____________

8. Where are you currently living? Please make a tick next to the type of housing that is closest to your current housing

In a house/flat/property that I own ☐
In council housing/local authority ☐
In private rented accommodation ☐
In accommodation owned by my family ☐
Housing association ☐
Other - please specify ☐

9. When you have a meal in your household, how many persons, including yourself, share food? (please write the number within each range)

Less than 4 years old ☐
5-11 years ☐
12-17 years ☐
18 years and over ☐

10. Do you smoke cigarettes?

Yes ☐
No ☐

Thank you for your participation in this study. If you have any queries regarding this questionnaire, please contact:

Maria Piacentini
Department of Applied Consumer Studies,
Queen Margaret College
Clerwood Terrace
Edinburgh, EH12 8TS.

The results will be available at a later date. Should you wish an annotated version please inform the interviewer.

Appendix 6 Principal components analysis scale of postcodes / wards

1.	-53.958	G2 .7
2.	-46.335	G1 .2
3.	-35.664	G5 .0
4.	-35.489	G5 .9
5.	-34.735	G31 .4
6.	-34.374	G21 .2
7.	-34.163	G1 .5
8.	-33.721	G22 .5
9.	-32.278	G4 .0
10.	-29.739	G40 .3
11.	-29.733	G45 .9
12.	-29.622	G45 .0
13.	-29.040	G20 .7
14.	-28.962	G15 .7
15.	-28.013	G40 .4
16.	-27.738	EH16.4 part
17.	-27.519	G20 .9
18.	-27.237	G34 .9
19.	-26.848	G31 .1
20.	-26.807	G33 .3
21.	-26.645	G15 .8 part
22.	-25.928	G22 .6
23.	-25.572	G51 .3
24.	-24.542	G21 .1 part
25.	-24.388	G2 .3
26.	-24.222	G33 .4
27.	-23.652	G42 .0
28.	-23.384	G40 .2
29.	-22.628	G51 .2
30.	-22.173	G32 .6
31.	-21.415	G31 .5
32.	-21.361	G22 .7
33.	-20.351	G20 .8
34.	-20.117	EH5 .1
35.	-19.904	G21 .4
36.	-19.669	G34 .0
37.	-19.523	G53 .6
38.	-18.921	G33 .5
39.	-18.838	G43 .1
40.	-18.356	G21 .3
41.	-17.725	G2 .6
42.	-17.460	EH1 .1
43.	-16.994	G52 .4 part

44.	-16.618	G51 .4
45.	-16.441	G31 .3
46.	-16.368	Lawrence Hill
47.	-16.111	G14 .0
48.	-15.646	EH2 .4
49.	-15.412	G53 .5
50.	-15.349	G32 .7
51.	-15.182	G13 .2
52.	-15.172	EH4 .4
53.	-15.106	G11 .6
54.	-15.104	G46 .8 part
55.	-15.034	G73 .1
56.	-14.219	G13 .4 part
57.	-13.297	G13 .3
58.	-13.236	G69 .8 part
59.	-13.164	G42 .7
60.	-13.140	G20 .0
61.	-12.594	G52 .1
62.	-12.057	EH11.3
63.	-11.980	G33 .2
64.	-11.670	G3 .8
65.	-9.561	EH1 .2
66.	-9.550	G15 .6
67.	-7.616	G72 .7
68.	-7.054	G53 .7 part
69.	-6.387	EH21.8 part
70.	-6.215	EH12.0
71.	-6.113	
72.	-5.614	EH14.2
73.	-5.593	G32 .8
74.	-5.470	G73 .5 part
75.	-5.350	G52 .2
76.	-5.255	G41 .1
77.	-5.061	Filwood
78.	-4.337	G73 .4 part
79.	-4.146	EH8 .9
80.	-3.679	G23 .5 part
81.	-3.168	EH7 .6
82.	-3.156	EH14.3
83.	-2.993	G40 .1
84.	-2.937	G4 .9
85.	-2.854	G46 .7 part
86.	-2.811	G3 .7
87.	-2.708	EH17.7
88.	-2.670	EH6 .6
89.	-2.587	G71 .7 part
90.	-2.547	G33 .1
91.	-2.482	EH15.3
92.	-2.039	G14 .9
93.	-1.714	EH17.8 part
94.	-1.709	Kingsweston

95.	-1.145	EH13.9
96.	-0.731	G51 .1
97.	-0.674	EH11.4
98.	-0.507	Whitchurch Park
99.	-0.272	G42 .8
100.	-0.203	G12 .8
101.	0.509	Southmead
102.	0.665	Lockleaze
103.	1.521	Knowle
104.	1.754	G32 .9
105.	1.798	G69 .7 part
106.	1.909	G1 .4
107.	2.265	G72 .8 part
108.	2.465	EH8 .8
109.	2.813	G52 .3 part
110.	2.839	EH1 .3
111.	2.881	G31 .2
112.	3.031	EH2 .2
113.	3.079	G32 .0
114.	3.161	EH16.5
115.	3.308	EH2 .3
116.	3.330	G73 .2
117.	3.674	G41 .5
118.	3.828	Ashley
119.	4.596	Hartcliffe
120.	4.753	EH4 .7
121.	5.014	G11 .5
122.	5.193	Bishopsworth
123.	5.318	Henbury
124.	6.485	G20 .6
125.	6.654	EH3 .9
126.	6.845	Avonmouth
127.	7.094	G42 .9
128.	7.232	EH16.6
129.	7.562	EH4 .2
130.	7.641	EH5 .2
131.	7.946	Frome Vale
132.	8.751	G43 .2
133.	8.901	EH3 .8
134.	8.975	Brislington East
135.	9.093	EH2 .1
136.	9.182	G73 .3
137.	9.207	EH3 .5
138.	9.336	EH6 .4
139.	9.390	Hillfields
140.	9.580	EH6 .8
141.	9.657	G11 .7
142.	9.953	G13 .1
143.	10.068	EH6 .5
144.	10.370	EH3 .6

145.	10.419	Windmill Hill
146.	10.881	Cabot
147.	11.090	Horfield
148.	11.253	St.George West
149.	11.524	G41 .2
150.	11.640	Southville
151.	11.836	EH11.2
152.	12.096	EH6 .7
153.	12.438	EH28.8
154.	12.676	G5 .8
155.	13.103	EH8 .7
156.	13.105	Stockwood
157.	13.567	Easton
158.	13.636	G64 .1 part
159.	13.838	EH7 .4
160.	14.053	EH7 .5
161.	14.085	G44 .5
162.	14.207	EH29.9
163.	14.246	G44 .4
164.	14.500	G2 .4
165.	14.724	G2 .8
166.	14.860	EH14.1
167.	14.923	G69 .6 part
168.	15.108	G41 .3
169.	15.211	EH15.2
170.	15.463	EH9 .1
171.	15.890	Bedminster
172.	16.142	G76 .9 part
173.	16.378	EH9 .3
174.	16.475	Hengrove
175.	16.560	G12 .0
176.	16.673	EH12.7
177.	16.717	EH9 .2
178.	16.898	EH20.9 part
179.	16.907	Clifton
180.	16.924	EH27.8 part
181.	17.209	EH14.4
182.	17.374	EH12.5
183.	17.489	G41 .4
184.	17.822	EH15.1
185.	17.841	EH30.9 part
186.	17.849	EH10.4
187.	17.888	EH10.5
188.	17.911	Cotham
189.	18.171	Brislington West
190.	18.231	G44 .3 part
191.	18.266	Eastville
192.	18.344	St.George East
193.	18.490	Stoke Bishop

194.	18.913	Westbury-On-Trym
195.	19.208	EH14.7
196.	19.739	Redland
197.	20.198	Henleaze
198.	20.748	Bishopston
199.	20.883	EH11.1
200.	21.306	EH14.5
201.	21.739	EH4 .5
202.	22.048	EH12.8
203.	22.629	EH5 .3
204.	22.755	EH12.9
205.	22.863	EH14.6
206.	22.960	EH10.6
207.	23.202	EH13.0
208.	23.233	EH3 .7
209.	23.650	EH12.6
210.	23.902	EH4 .1
211.	23.924	G12 .9
212.	24.955	EH4 .6
213.	25.806	EH4 .3
214.	27.754	EH10.7 part
215.	28.235	G1 .1
216.	30.005	G61 .1 part
217.	30.120	G33 .6 part
218.	32.222	EH4 .8

Appendix 7 Final questionnaire

Queen Margaret College

EDINBURGH

FRUIT AND VEGETABLE QUESTIONNAIRE

Enquiries to:
Maria Piacentini
Department of Applied Consumer Studies
Queen Margaret College
Clerwood Terrace
EH12 8TS
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Introduction

We are carrying out a study of eating habits in the UK in order to gain a better understanding of the food choices people make. This questionnaire contains questions which are related to your shopping habits and opinions concerning food generally, and about fruit and vegetables particularly.

As it is important that you give some thought to these questions, we are leaving the questionnaire with you to fill in at a time that suits you. Most of the questions involve you reading a statement and ticking the box that is most relevant to you. If you have any questions or difficulties, the interviewer will be happy to help you at the time of collection.

The questionnaire will take about 20-25 minutes to complete. Please take your time and make sure all questions are answered. The interviewer will pick up the questionnaire at a time that is convenient to you.

The contents of this form are ***absolutely confidential.*** Information identifying the respondent will not be disclosed under any circumstances.

Thank you for your help,

Maria Piacentini
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Queen Margaret College
Clerwood Terrace
EH12 8TS.
tel: (0131) 317 3454

Pamela Turner
Department of Applied Consumer Studies
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A. Shopping and use of fruit and vegetables

Please read the following questions and tick the appropriate box. For questions 1 - 6, please tick one box only (that is, the one most relevant to you).

1. Who plans meals for your household?

You ☐
Your spouse/partner ☐
Both of you ☐
Other - please specify ________

2. Who shops for food for your household?

You ☐
Your spouse/partner ☐
Both of you ☐
Other - please specify ________

3. Who prepares/cooks meals for your household?

You ☐
Your spouse/partner ☐
Both of you ☐
Other - please specify ________

4. a) Where do you mainly buy fruit?

Supermarket ☐ Home Grown ☐
Market ☐ Other
Greengrocers ☐ ________

b) Where do you mainly buy vegetables?

Supermarket ☐ Home Grown ☐
Market ☐ Other
Greengrocers ☐ ________

5. a) How far do you normally travel to buy fruit?

Less than 1 mile ☐ 6-10 miles ☐
1-3 miles ☐ More than 10 miles ☐
4-5 miles ☐

b) How far do you normally travel to buy vegetables?

Less than 1 mile ☐ 6-10 miles ☐
1-3 miles ☐ More than 10 miles ☐
4-5 miles ☐

6. a) Which one of these forms of transport do you mainly use to go shopping for fruit?
(please tick the *main* mode of transport only)

Walk ☐ Taxi ☐
Bus ☐ Train ☐
Car ☐ Other ________

b) Which one of these forms of transport do you mainly use to go shopping for vegetables?
(please tick the *main* mode of transport only)

Walk ☐ Taxi ☐
Bus ☐ Train ☐
Car ☐ Other ________

	Extremely poor						Extremely good
7. a) How how good is the variety of *fruit* available in the area where you live?	☐	☐	☐	☐	☐	☐	☐
b) How how good is the variety of *vegetables* available in the area where you live?	☐	☐	☐	☐	☐	☐	☐

	Extremely unacceptable						Extremely acceptable
8. a) How acceptable would you say *frozen* vegetables are as an alternative to fresh?	☐	☐	☐	☐	☐	☐	☐
b) How acceptable would you say *tinned* vegetables are as an alternative to fresh?	☐	☐	☐	☐	☐	☐	☐

	Extremely unversatile						Extremely versatile
9. a) How versatile would you say *fruit* is?	☐	☐	☐	☐	☐	☐	☐
b) How versatile would you say *vegetables* are?	☐	☐	☐	☐	☐	☐	☐

10. How likely is it that you would eat fruit (including dried fruit) as part of the following meals?

	Highly unlikely						Highly likely
Breakfast	☐	☐	☐	☐	☐	☐	☐
Mid-morning snack	☐	☐	☐	☐	☐	☐	☐
Lunch	☐	☐	☐	☐	☐	☐	☐
Afternoon snack	☐	☐	☐	☐	☐	☐	☐
Evening meal	☐	☐	☐	☐	☐	☐	☐
Late evening snack/supper	☐	☐	☐	☐	☐	☐	☐

11. How likely is it that you would eat vegetables as part of the following meals?

	Highly unlikely						Highly likely
Breakfast	☐	☐	☐	☐	☐	☐	☐
Mid-morning snack	☐	☐	☐	☐	☐	☐	☐
Lunch	☐	☐	☐	☐	☐	☐	☐
Afternoon snack	☐	☐	☐	☐	☐	☐	☐
Evening meal	☐	☐	☐	☐	☐	☐	☐
Late evening snack/supper	☐	☐	☐	☐	☐	☐	☐

B. Food Choice

These questions are to do with your personal choices relating to eating foods. Part 1 is about *all foods* in general. Part 2 is about *fruit* and part 3 is about *vegetables*.
Read each of these statements. Please indicate how much you DISAGREE or AGREE with each of them from 1 (strongly disagree) to 7 (strongly agree).

*1. Generally it is important to me when I am choosing **FOOD** that:*

	Strongly disagree	Quite disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Quite agree	Strongly agree
It looks like good quality	☐	☐	☐	☐	☐	☐	☐
It tastes good	☐	☐	☐	☐	☐	☐	☐
It is NOT messy to eat	☐	☐	☐	☐	☐	☐	☐
It is light to carry	☐	☐	☐	☐	☐	☐	☐
My spouse/partner likes it	☐	☐	☐	☐	☐	☐	☐
My children like it	☐	☐	☐	☐	☐	☐	☐
It is healthy for my family	☐	☐	☐	☐	☐	☐	☐
It sets a good example for my family	☐	☐	☐	☐	☐	☐	☐
It is accepted by other members of my family	☐	☐	☐	☐	☐	☐	☐
It keeps me healthy	☐	☐	☐	☐	☐	☐	☐
It fits in with my eating habits	☐	☐	☐	☐	☐	☐	☐
It improves my overall appearance	☐	☐	☐	☐	☐	☐	☐
It helps me to lose weight	☐	☐	☐	☐	☐	☐	☐
It helps me to maintain my weight	☐	☐	☐	☐	☐	☐	☐
It is good for my skin	☐	☐	☐	☐	☐	☐	☐
It cheers me up	☐	☐	☐	☐	☐	☐	☐
It is interesting	☐	☐	☐	☐	☐	☐	☐
It has a variety of textures	☐	☐	☐	☐	☐	☐	☐
It has a variety of flavours	☐	☐	☐	☐	☐	☐	☐
It is comforting to eat	☐	☐	☐	☐	☐	☐	☐
It is convenient to eat	☐	☐	☐	☐	☐	☐	☐
It fits in with a medically supervised diet	☐	☐	☐	☐	☐	☐	☐

2. *Specifically, it is important to me when I am choosing **FRUIT** that:*

	Strongly disagree	Quite disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Quite agree	Strongly agree
It looks like good quality	☐	☐	☐	☐	☐	☐	☐
It tastes good	☐	☐	☐	☐	☐	☐	☐
It is NOT messy to eat	☐	☐	☐	☐	☐	☐	☐
It is light to carry	☐	☐	☐	☐	☐	☐	☐
My spouse/partner likes it	☐	☐	☐	☐	☐	☐	☐
My children like it	☐	☐	☐	☐	☐	☐	☐
It is healthy for my family	☐	☐	☐	☐	☐	☐	☐
It sets a good example for my family	☐	☐	☐	☐	☐	☐	☐
It is accepted by other members of my family	☐	☐	☐	☐	☐	☐	☐
It keeps me healthy	☐	☐	☐	☐	☐	☐	☐
It fits in with my eating habits	☐	☐	☐	☐	☐	☐	☐
It improves my overall appearance	☐	☐	☐	☐	☐	☐	☐
It helps me to lose weight	☐	☐	☐	☐	☐	☐	☐
It helps me to maintain my weight	☐	☐	☐	☐	☐	☐	☐
It is good for my skin	☐	☐	☐	☐	☐	☐	☐
It cheers me up	☐	☐	☐	☐	☐	☐	☐
It is interesting	☐	☐	☐	☐	☐	☐	☐
It has a variety of textures	☐	☐	☐	☐	☐	☐	☐
It has a variety of flavours	☐	☐	☐	☐	☐	☐	☐
It is comforting to eat	☐	☐	☐	☐	☐	☐	☐
It is convenient to eat	☐	☐	☐	☐	☐	☐	☐
It fits in with a medically supervised diet	☐	☐	☐	☐	☐	☐	☐

3. *Specifically, it is important to me when I am choosing* ***VEGETABLES*** *that:*

	Strongly disagree	Quite disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Quite agree	Strongly agree
They look like good quality	☐	☐	☐	☐	☐	☐	☐
They taste good	☐	☐	☐	☐	☐	☐	☐
They are NOT messy to eat	☐	☐	☐	☐	☐	☐	☐
They are light to carry	☐	☐	☐	☐	☐	☐	☐
My spouse/partner likes them	☐	☐	☐	☐	☐	☐	☐
My children like them	☐	☐	☐	☐	☐	☐	☐
They are healthy for my family	☐	☐	☐	☐	☐	☐	☐
They set a good example for my family	☐	☐	☐	☐	☐	☐	☐
They are accepted by other members of my family	☐	☐	☐	☐	☐	☐	☐
They keep me healthy	☐	☐	☐	☐	☐	☐	☐
They fit in with my eating habits	☐	☐	☐	☐	☐	☐	☐
They improve my overall appearance	☐	☐	☐	☐	☐	☐	☐
They help me to lose weight	☐	☐	☐	☐	☐	☐	☐
They help me to maintain my weight	☐	☐	☐	☐	☐	☐	☐
They are good for my skin	☐	☐	☐	☐	☐	☐	☐
They cheer me up	☐	☐	☐	☐	☐	☐	☐
They are interesting	☐	☐	☐	☐	☐	☐	☐
They have a variety of textures	☐	☐	☐	☐	☐	☐	☐
They have a variety of flavours	☐	☐	☐	☐	☐	☐	☐
They are comforting to eat	☐	☐	☐	☐	☐	☐	☐
They are convenient to eat	☐	☐	☐	☐	☐	☐	☐
They fit in with a medically supervised diet	☐	☐	☐	☐	☐	☐	☐

*4. Please indicate how much you agree or disagree with the following statements about **FRUIT***

	Strongly disagree	Quite disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Quite agree	Strongly agree
There is a lot of waste when you buy fruit	☐	☐	☐	☐	☐	☐	☐
Fruit takes a long time to prepare	☐	☐	☐	☐	☐	☐	☐
Fruit takes a long time to shop for	☐	☐	☐	☐	☐	☐	☐
Fruit makes a good snack	☐	☐	☐	☐	☐	☐	☐
Fruit is filling	☐	☐	☐	☐	☐	☐	☐
Fruit is expensive	☐	☐	☐	☐	☐	☐	☐
Fruit is easily available	☐	☐	☐	☐	☐	☐	☐
People who are important to me think eating fruit is a good thing	☐	☐	☐	☐	☐	☐	☐
Eating fruit can protect me against illness in later life	☐	☐	☐	☐	☐	☐	☐
I intend to eat more fruit within the next year	☐	☐	☐	☐	☐	☐	☐

*5. Please indicate how much you agree or disagree with the following statements about **VEGETABLES***

	Strongly disagree	Quite disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Quite agree	Strongly agree
There is a lot of waste when you buy vegetables	☐	☐	☐	☐	☐	☐	☐
Vegetables take a long time to prepare	☐	☐	☐	☐	☐	☐	☐
Vegetables take a long time to shop for	☐	☐	☐	☐	☐	☐	☐
Vegetables are good for a snack	☐	☐	☐	☐	☐	☐	☐
Vegetables are filling	☐	☐	☐	☐	☐	☐	☐
Vegetables are expensive	☐	☐	☐	☐	☐	☐	☐
Vegetables are easily available	☐	☐	☐	☐	☐	☐	☐
People who are important to me think eating vegetables is a good thing	☐	☐	☐	☐	☐	☐	☐
Eating vegetables can protect me against illness in later life	☐	☐	☐	☐	☐	☐	☐
I intend to eat more vegetables within the next year	☐	☐	☐	☐	☐	☐	☐

C. Food consumption

This section is about the amount of fruit and vegetables you eat, and when you eat them. Please fill in the number of times you ate each of the following in the last seven days.

1. In the last seven days, how many times have you had **an item or portion of fruit (fresh, dried or tinned)?** ________times

2. In the last seven days, how many times have you had **a cup or glass of fruit juice?** ________times

3. In the last seven days, how many times have you had **vegetables (excluding potatoes) with a main meal?** ________times

4. a) In the last seven days, how many times have you had **vegetables as a snack?** ________times

   b) In the last seven days, how many times have you had **fruit as a snack?** ________times

5. a) In the last seven days, how many times have you had **a side salad with a meal?** ________times

   b) In the last seven days, how many times have you had **vegetables in a casserole?** ________times

   c) In the last seven days, how many times have you had **vegetables in a soup?** ________times

   d) In the last seven days, how many times have you had **vegetables cooked in a sauce (e.g. with pasta)?** ________times

   e) In the last seven days, how many times have you had **vegetables cooked as a vegetables dish (e.g. cauliflower cheese)?** ________times

6. a) In the last seven days, how many times have you had **a salad as a main meal?** ________times

   b) In the last seven days, how many times have you had **a vegetarian meal?** ________times

D. Food habits

1. Are you vegetarian?

Yes ☐
No ☐

2. How often do you eat a breakfast (cooked or uncooked)?

Every day ☐
Most days (3-6) ☐
Once or twice a week ☐
Less than once per week ☐
Never ☐

3. a) How many other main or cooked meals do you usually have (that is a meal that has a main course with 1 or more vegetables)?

Number of main meals a day ___

b) How many lighter meals (e.g. sandwiches) do you usually have during the day?

Number of light meals a day ___

4. How often do you have a meal away from home (light meals or main meals)?

More than once per day ☐
Once a day ☐
Most days ☐
Once or twice per week ☐
Less than once per week ☐
Never ☐

5. How often do you have a carry out/take-away meal at home?

More than once per day ☐
Once a day ☐
Most days ☐
Once or twice per week ☐
Less than once per week ☐
Never ☐

6. How many times a day do you have a snack or something to eat between meals or before going to bed?

Once or twice ☐
3 or 4 times ☐
More than 4 times ☐
Never ☐

7. Do you eat regularly, that is have the same number of meals and snacks at roughly the same time each day?

- Yes ☐
- No ☐
- Varies ☐

8. a) In your judgement, do you eat the right amount of foods to keep you healthy?

- Yes ☐
- No - too little ☐
- No - too much ☐
- Don't know ☐

b) In your judgement, do you eat the right type of food to keep you healthy?

- Yes ☐
- No ☐

E. Personal Details

To help us classify your answers and make some statistical comparisons, we would like you to answer some brief questions about you and your household.

1. Are you?

- Male ☐
- Female ☐

2. Which age group do you belong to?

- Aged under 25 ☐
- 25-34 ☐
- 35-44 ☐
- 45-54 ☐
- 55-64 ☐
- 65-74 ☐
- 75 and over ☐

3. What is your postcode? ☐☐☐☐☐☐☐

4. a) What is your job title? (If retired, indicate previous title). Please be as specific as possible. ________

b) What is your spouse's job title? (If retired, indicate previous job title). Please be as specific as possible. ________

5. What is the highest level of qualification you have achieved?

- None ☐
- GCSE or equivalent ☐
- Craft/guild/technical ☐
- Apprenticeship ☐
- Higher education - none degree ☐
- First degree ☐
- Higher degree ☐
- Chartered professional qualification ☐
- Other - please specify ________

6. What was the highest level of qualification your father achieved?

- None ☐
- GCSE or equivalent ☐
- Craft/guild/technical ☐
- Apprenticeship ☐
- Higher education - none degree ☐
- First degree ☐
- Higher degree ☐
- Chartered professional qualification ☐
- Don't know ☐
- Other - please specify ____________________

7. What was your father's occupation when you were aged ten? ____________________

8. Where are you currently living? Please tick the type of housing that is closest to your current housing

- In a house/flat/property that I own ☐
- In council housing/local authority ☐
- In private rented accommodation ☐
- In accommodation owned by my family ☐
- Housing association ☐
- Other - please specify ____________________

9. When you have a meal in your household, how many persons, including yourself, share food?

(please write the number in each age group)

- Less than 4 years old ☐
- 5-11 years ☐
- 12-17 years ☐
- 18 years and over ☐

10. Do you smoke cigarettes?

- Yes ☐
- No ☐

<u>*Please check that you have answered all the questions.*</u>

Thank you for your participation in this study.

The results will be available at a later date. If you would like a summary of these please let us know when the questionnaire is collected.

Appendix 8 Letter requesting participation

October 1995

Dear

We are carrying out a study of eating habits around Britain to gain a better understanding of the food choices people make. You have been chosen, at random from the Electoral Register, to take part in this study. We would like you to help us by answering some questions about the food you eat.

Over the next few days one of our interviewers will come to your house with a questionnaire for you to fill in. Because we would like you to give some thought to the questions, the questionnaire will be left for you to complete in your own time. We will arrange to pick it up at a suitable time.

You are under no obligation to fill in this questionnaire, but your co-operation would be very much appreciated.

Your answers to the questionnaire will be treated as ***absolutely confidential.*** Although this information is not anonymous, personal information will be destroyed at the data processing stage.

If you have any questions about the study, please contact either:

Pamela Turner	or	Maria Piacentini
Senior Lecturer		Research Student
Dept. of Applied Consumer Studies		Dept. of Applied Consumer Studies
Queen Margaret College		Queen Margaret College
Edinburgh.		Edinburgh.
(0131) 317 3466		(0131) 317 3454

Thank you in anticipation of your help. We look forward to seeing you.

Yours sincerely,

Maria Piacentini.

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